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SPECTRAL REFLECTANCE SIGNATURES

OF COASTAL POLLUTANTS

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V. Klemas
W. Philpot
College of Marine Studies
University of Delaware

(E77-10011) SPECTRAL REFLECTANCE SIGNATURES
OF COASTAL POLLUTANTS Progress Report
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CSCS 13B

G3/43

Unclass
00011

October 18, 1976
Progress Report
Contract NSG 1149

Original photography may be purchased from:
EROS Data Center
10th and Dakota Avenue
Sioux Falls, SD 57198

Prepared for
NASA Langley Research Center
Hampton, Virginia



This progress report is a presentation of the data collected on the two cruises to the duPont dump site; the first on August 28, 1975, the second on June 26, 1976. Analyses of the data will be presented in later reports.

Methods and Instrumentation:

1. Hydrocast.

a) Depth. Water samples were taken using 5 liter Niskin bottles at the depths indicated. The bottles are a little less than 1 m in length, thus there would be an uncertainty in the depth of about 1/2 meter. This is most critical for the surface sample. On August 28 the surface sample was collected in the Niskin bottles and the depth would be more realistically taken as 0.5 m. On June 26 the surface sample was collected using a plastic bucket and may be taken as a true surface sample. There is no error due to wire angle since on both days the wire angle was near 0°.

b) pH, Salinity (S), Iron (Fe) and Chlorophyll a (chl a). These are measurements made on water samples which were iced immediately upon transfer from the sampling bottles. The analyses were performed at Langley Research Center (NASA) and are taken from the NASA Data Report on this project. The chlorophyll samples were filtered as soon as possible after collection. On August 28 this was immediately upon return to shore. On June 26 the samples were filtered on board ship immediately after sampling. In both cases the filters were stored in light tight containers and chilled until they were analyzed.

c) Seston Weight (Delaware). The procedure for determining Seston weight used by the Sediments Laboratory at the University of Delaware differs slightly from the standard techniques. In the Delaware procedure two filters are used for each sample. The second filter, like the first, is dried and weighed prior to filtering. It is placed underneath the first filter during

filtering. Both are then dried and reweighed. Any increase in weight on the second filter is assumed to be due to dissolved salts adhering to the filter. It is further assumed that the same weight of salt would have adhered to the first filter and is subtracted from the usual value of the sediment weight to obtain a value corrected for salt content.

$$(w_f - w_i) - (w'_f - w'_i) = \text{salt corrected seston weight}$$

where w_f = dry weight of first filter after filtration and drying.

w_i = dry weight of first filter.

w'_f = weight of second filter after filtration and drying.

w'_i = dry weight of second filter.

2. Secchi Depth.

The secchi disc used was a two foot diameter white disc with a one foot by one foot black letter U on top. The line thickness of the lettering was one inch. When only one value of the secchi depth is given it is the depth at which the disc disappears as it is being lowered. When a second value is given it is the depth at which the letter U could no longer be distinguished.

3. CTD (Conductivity, Temperature and Depth probe).

(To be completed at a later date)

4. Transmissometer.

The Hydroproducts transmissometer, Model 612S, was used with the 1 meter path length. The optical response is photometric -- very nearly a CIE response. The attenuation coefficient α in lumens/meter is given by:

$$\alpha = -\ln (T/100)$$

5. Submarine Photometer.

(To be completed at a later date.)

6. RPMI.

The Radiant Power Measuring Instrument was designed and built by Bendix Corporation. It is a four-band radiometer capable of measuring both radiance and irradiance in the four LANDSAT bands. Three measurements were made on August 28 at the time of the LANDSAT overpass:

H_t = total irradiance (downwelling). The cosine response sensor is directed upward and levelled as well as possible.

H_{sky} = skylight irradiance (downwelling). This is identical to the measurement of H_t except that the sensor is shaded from direct sunlight.

N_w = upwelling radiance from the water. The sensor is fitted with a black tube which limits the field of view to $\sim .0132$ steradians and directed vertically down towards the water.

All RPMI measurements were made from the bow of the ship on the side of the sun in order to minimize reflection from the side of the ship.

7. Spectroradiometer (United Detector Technology (UDT) Model 1100B).

This is a continuous scanning device which is sensitive to the range of wavelengths from .4 to 1.1 μ . The spectral separation is accomplished using two circularly variable interference filters, one for the visible (400-700 nm) and one for the infrared (700-1100 nm).

The band width of the visible range filter is 17 nm while the band width of the infrared range filter is a little broader -- about 25 nm. The data for the visible region is presented in 10 nm increments. This is meant to facilitate comparison with other sensors and is not meant to imply any improvements in the spectral resolution.

The response of the 1100B is flat over the entire region of sensitivity. This is accomplished by using a variable aperture size. As the sensor

sensitivity decreases, the aperture size increases, thus increasing the area of the sensor which is illuminated. This requires a diffusing plate in the input optics to insure that the illumination is even over the largest possible aperture area (Fig. 1). Unfortunately this diffusion is not Lambertian. In fact, the response is quite directional departing significantly from cosine response (Fig. 2).

This places a restraint on using the 1100B with extended sources: the field of view must be limited to a small solid angle. For this reason the 1100B was fitted with a field limiting tube (anodized aluminum) giving a field of view with a half angle of 4° or a solid angle of .0153 steradians.

As with the RPMI, all measurements were made from the bow of the ship and on the side of the sun. The 1100B was fitted with the 30 cm field limiting tube for all measurements.

N_w - upwelling radiance. The sensor is directed vertically down at the water.

N_z - zenith skylight radiance. The sensor is directed vertically up at the sky.

H_\odot - solar irradiance. The sensor is aimed directly at the sun.

In this case the field-limiting tube serves the purpose of blocking out skylight. The solar disc subtends a smaller solid angle than that defined by the tube. Thus the measure is of solar irradiance.

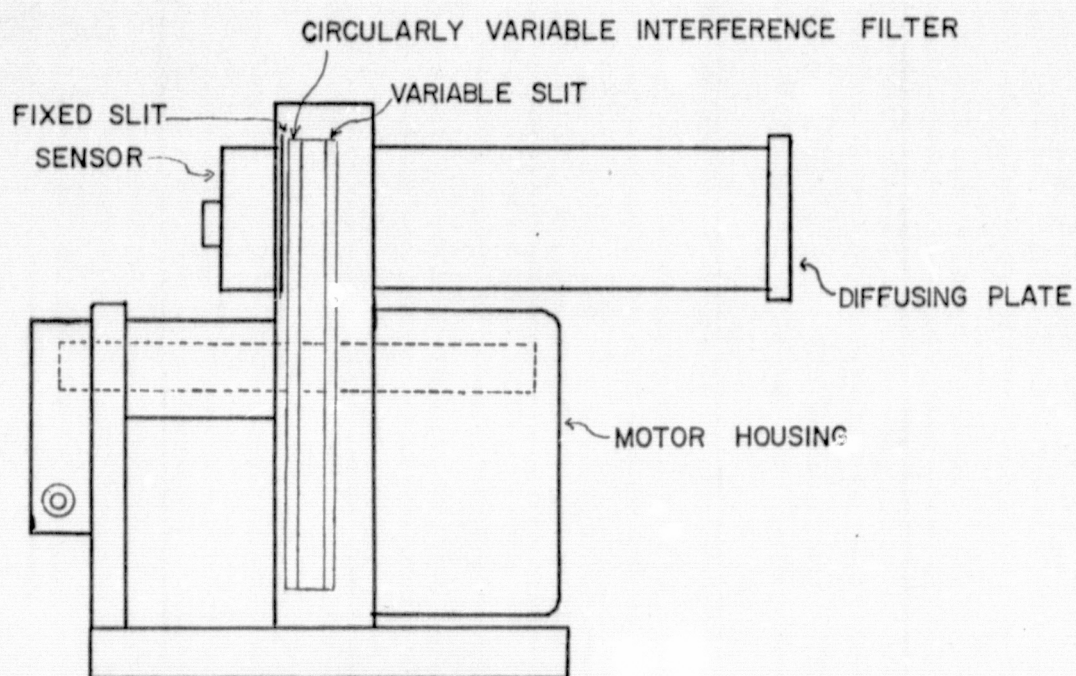
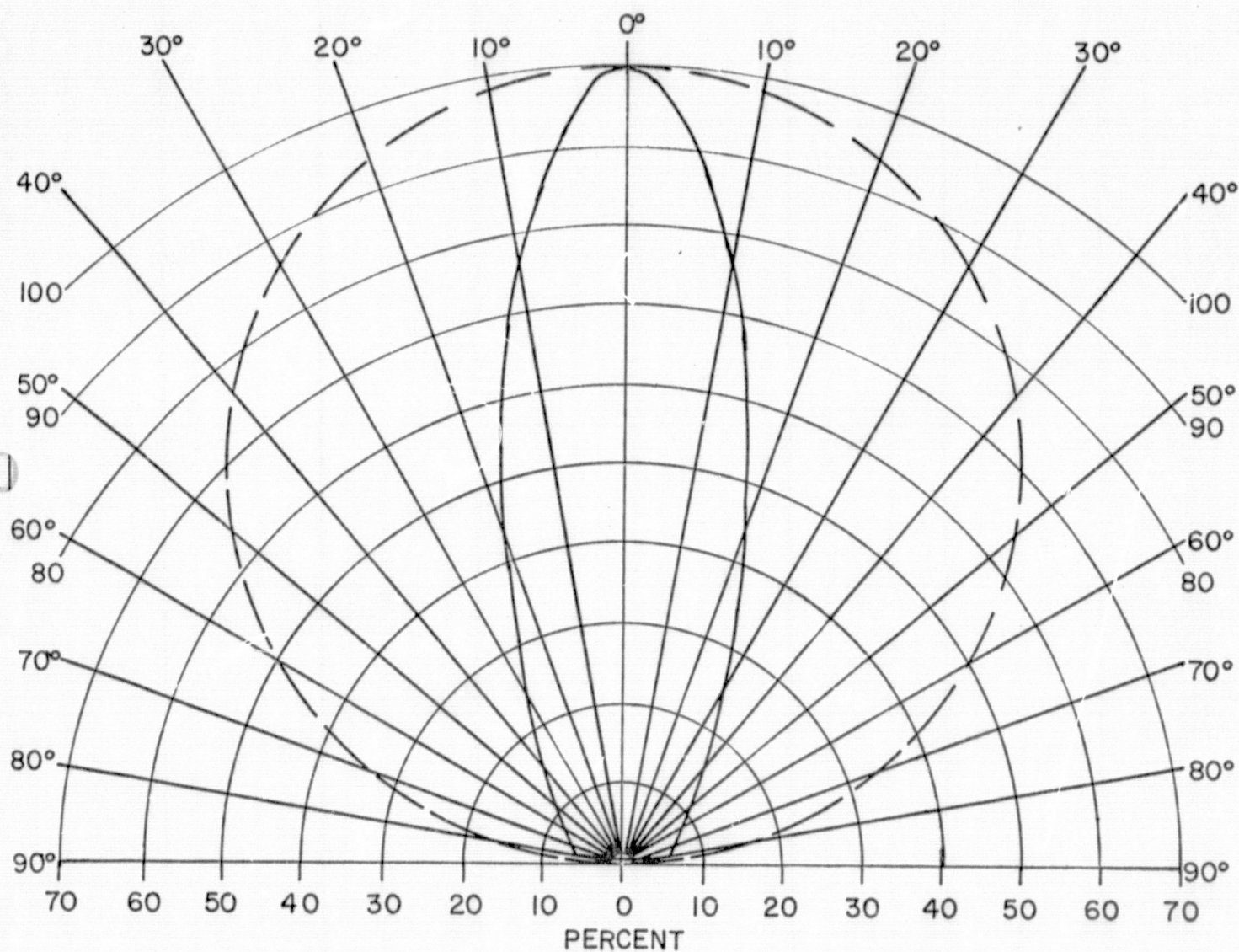


FIGURE 1. UDT SCANNING SPECTRORADIOMETER

FIGURE 2. DIRECTIONAL RESPONSE OF DIFFUSING PLATE

— — COSINE RESPONSE
—— INSTRUMENT RESPONSE



The Modular Multispectral Scanner (M²S) is an eleven channel scanner (Table 1) built by Bendix Corporation. The M²S was flown over the test site on August 28 in a specially adapted twin engine Cessna. The aircraft approached the test site in the morning at 13,000 ft. and made one pass at that altitude (1D 92). It then dropped to 3,000 ft. and remained at that altitude for the remaining morning flight lines. The same pattern was flown in the afternoon with 1D 77 and 78 being flown at 13,000 ft. and the remaining flight lines being flown at 3,000 ft. The M²S has an instantaneous field of view of 2.5 m rad. thus the pixel resolution is approximately 7.5 m at 3,000 ft. and 33 m at 13,000 ft.

Data from this instrument is digitized and placed on magnetic tape. It is presented here in two forms: photographic reproductions from band 5 of the scanner, and a computer printout of the same band. Both are presented as visual aids in choosing the pixels on the digital tapes which correspond to the ground truth collected from the research vessel. The computer printouts bear some further explanation. The radiance for each band of each pixel on the digital tapes is represented by a number between 0 and 255. Since the waste appears "brighter" than the surrounding water in all bands, it is possible to choose a cutoff value which will distinguish between the two. Any value below the cutoff, labeled BACKGROUND LEVEL on the printout, represents water and no character is printed for that pixel. Any value above the cutoff represents a "brighter" target, whether it is waste, sun glint or a ship, and a character is printed for that pixel. The character printed represents a range of radiance values. This range is determined by the INTERVAL. An interval of 5 means that any single character represents five radiance levels in the digital data.

The characters are arranged in a sequence corresponding to an increase in radiance values. In this sequence a point represents the background level, 0 represents the next highest radiance level, then 1, 2, 3 ..., 9, A, B, ..., Z

TABLE 1
BENDIX M²S 11-Channel Scanner

Band No.	center wavelength λ_e (μ)	bandwidth $\Delta\lambda$ (μ)
1	0.410	0.06
2	0.465	0.05
3	0.515	0.04
4	0.560	0.04
5	0.600	0.04
6	0.640	0.04
7	0.680	0.04
8	0.720	0.04
9	0.810	0.10
10	1.015	0.09
11	$\lambda > 1.5\mu\text{m}$ - bandwidth determined by detector and filter selection	

representing higher and higher radiances. If the radiance level is so high as to exceed the range allowed for by this scheme an @ is printed for that pixel.

As an example, let the BACKGROUND LEVEL be 60 and the INTERVAL be 5. The exact correspondence of the radiance levels on the digital tape and the characters on the computer printout is given in Table 2.

When the research vessel R/V Annandale appears in the scene it is outlined in red, on the printout.

9. LANDSAT

The treatment of the 4-band LANDSAT Imagery (Table #) is essentially the same as that of the M^2S data. The digital data, however, is limited to a range of 0-63. Because of the limited range the interval is set at 1.

The tug and a barge which were dumping the waste appear in the LANDSAT scene and are outlined in red on the printout. They were headed due north (toward the top of the page) at the time of the overpass.

TABLE 2 Correspondence of digital radiance levels and characters on the computer printout.

BACKGROUND LEVEL = 60

INTERVAL = 5

Character	Radiance Level	Character	Radiance Level
blank	<60	H	150-154
.	60-64	I	155-159
0	65-69	J	160-164
1	70-74	K	165-169
2	75-79	L	170-174
3	80-84	M	175-179
4	85-89	N	180-184
5	90-94	O	185-189
6	95-99	P	190-194
7	100-104	Q	195-199
8	105-109	R	200-204
9	110-114	S	205-209
A	115-119	T	210-214
B	120-124	U	215-219
C	125-129	V	220-224
D	130-134	W	225-229
E	135-139	X	230-234
F	140-144	Y	235-239
G	145-149	Z	240-244
		@	>244

TABLE 3 LANDSAT

Band No.	$\lambda(\mu)$
4	.5-.6
5	.6-.7
6	.7-.8
7	.8-1.1

Date 8/28/75

STATION: 1-0

Location: 38°33.7'N-74°22.8'W
(52173.8/70393.1)

Description: NW Corner - diagonal leg

Time: 0900-0920
Sun angle:
Wind Speed: 1.5 knots
Direction: 040°
Wave Height: 2 1/2 ft.
Surface Temp.: 25.0°C
Weather: Clear

Hydrocast:

<u>Time</u>	<u>Depth</u> <u>m</u>	<u>pH</u>	<u>S</u> <u>‰</u>	<u>Fe</u> ¹ <u>mg/l</u>	<u>Chl</u> <u>a</u> <u>µg/l</u>	<u>Seston Weight (mg/l)</u>		<u>Delaware</u>			
						<u>NASA</u>	<u>% vol</u>	<u>Total</u> ²	<u>% vol</u> ²	<u>Total</u> ³	<u>% vol</u> ³
0900	Surface	8.0	32.2	0.72	1.9	7.1	54.9	7.05	19.1	3.01	45.1
	2	--	--	--	1.32	--	--	7.26	23.4	1.79	95.2
	4	8.1	32.3	0.22	1.2	1.4	35.7	8.00	35.4	5.69	49.9
	8	8.1	32.1	0.14	1.5	--	--	8.04	26.2	--	--

BT Cast: 9095

Surface Temperature = 25.0°C

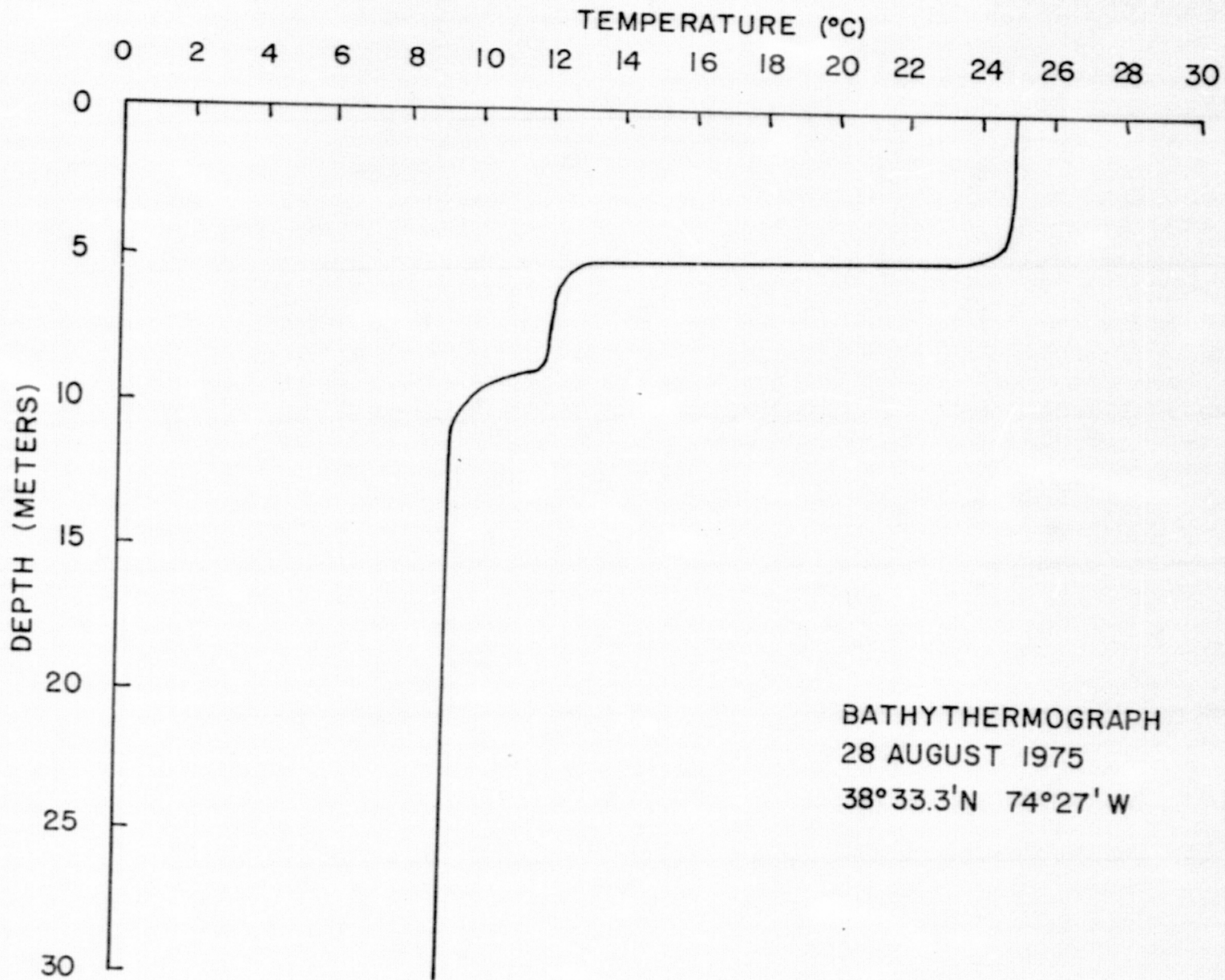
Secchi Depth: 3.5 m

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

¹Iron in suspended solids

²Analysis without salt correction

³This analysis includes a correction for salt content



Date: 8/28/75

STATION: 1-1A

Location: 38°34.0'N-74°23.9'W
(52176.5/70387.9)

Description: NW Corner - diagonal leg
M²S 0922-1092 @ 13000 ft.
ID 92.

Time: 0919-0940
Sun angle: 0938/ $\theta = 35^\circ$
Wind Speed: 16 knots
Wind Direction: 030°
Wave Height: 2 1/2 ft.
Surface Temp.: --
Weather: Clear

Hydrocast:

<u>Time</u>	<u>Depth</u> <u>m</u>	<u>pH</u>	<u>S</u> <u>‰</u>	<u>Fe</u> ¹ <u>mg/l</u>	<u>Chl</u> <u>g/l</u>	<u>Seston Weight (mg/l)</u>					
						<u>NASA</u>	<u>Delaware</u>		<u>Total</u> ³		
						<u>Total</u>	<u>% vol</u>	<u>Total</u> ²	<u>% vol</u> ²	<u>Total</u> ³	<u>% vol</u> ³
0925	Surface	8.1	32.1	0.21	1.2	1.4	2.14	7.26	30.9	4.73	47.5
	2	--	--	--	2.2	--	--	7.85	19.4	4.81	31.6
	4	8.1	32.2	0.30	1.8	2.0	40.0	5.18	36.8	3.39	61.4
	8	8.1	32.3	0.40	1.5	--	--	9.25	33.8	5.17	60.6

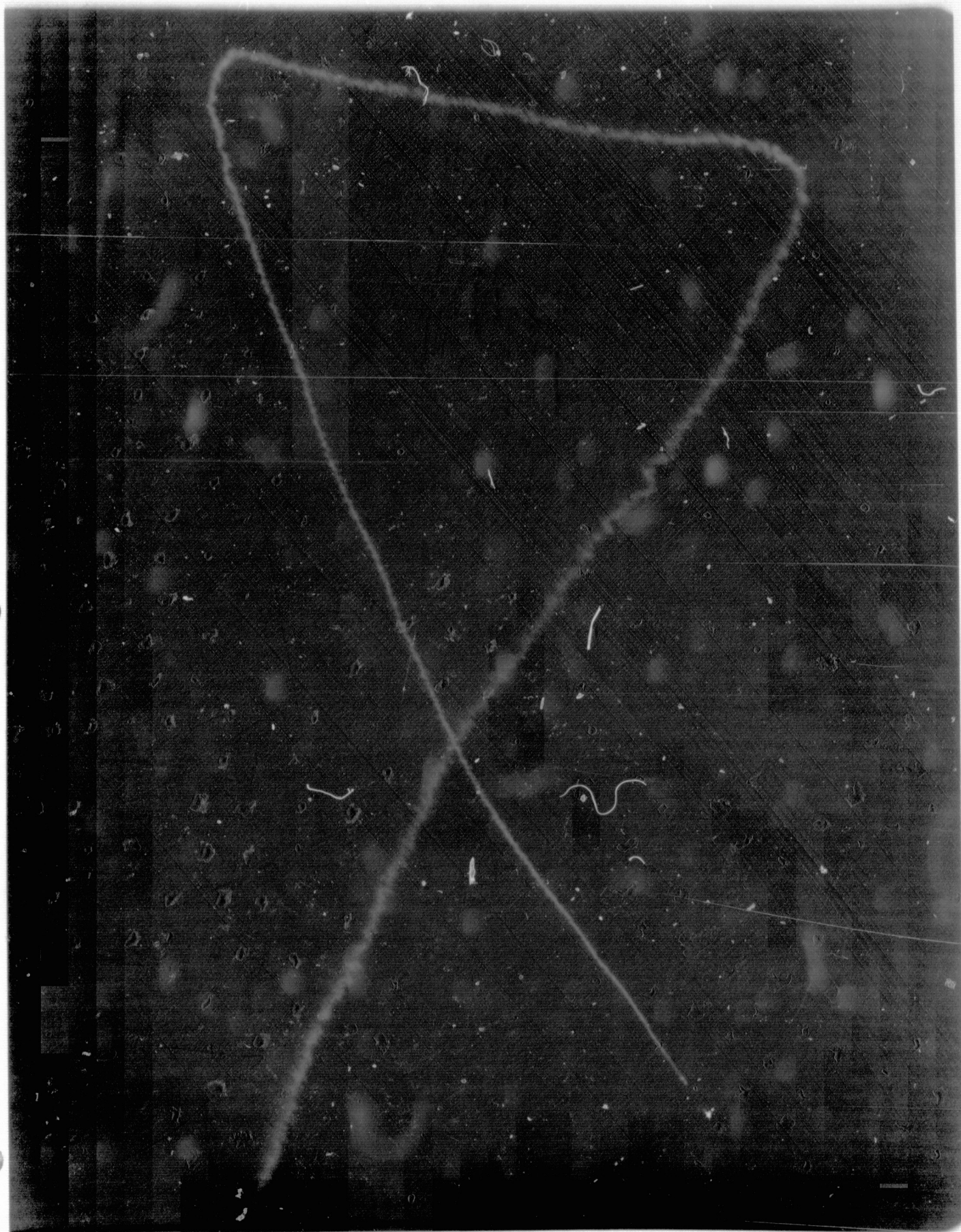
Secchi Depth: 3.5 m 9030

¹Iron in suspended solids

²Without salt correction

³With salt correction

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Date 8/28/75

STATION 1-1B

Location: 38°34.2'N-74°24.4'W
(52177.9/70386.2)

Description: NW Corner - diagonal leg
M²S-0953 10 90

Time: 0940-1000
Sun Angle: 0948/θ = 39°
Wind Speed: 15 knots
Wind Direction: 015°
Wave Height: 2 1/2 ft.
Surface Temp.: 24.9°C
Weather: Clear

Hydrocast:

Time	Depth m	pH	S ‰	Fe ¹ mg/l	Chlα μg/l	Seston Weight (mg/l)					
						NASA Total	% vol	Delaware Total ²	% vol ²	Total ³	% vol ³
0950	Surface	8.0	32.2	0.62	1.2	3.1	48.4	6.42	35.6	4.77	54.6
	2	--	--	--	1.5	--	--	6.38	25.1	3.27	49.0
	4	8.0	32.4	0.67	1.24	4.0	52.5	6.90	24.1	4.30	38.7
	8	8.1	32.1	0.42	1.5	--	--	11.11	33.7	7.73	48.5

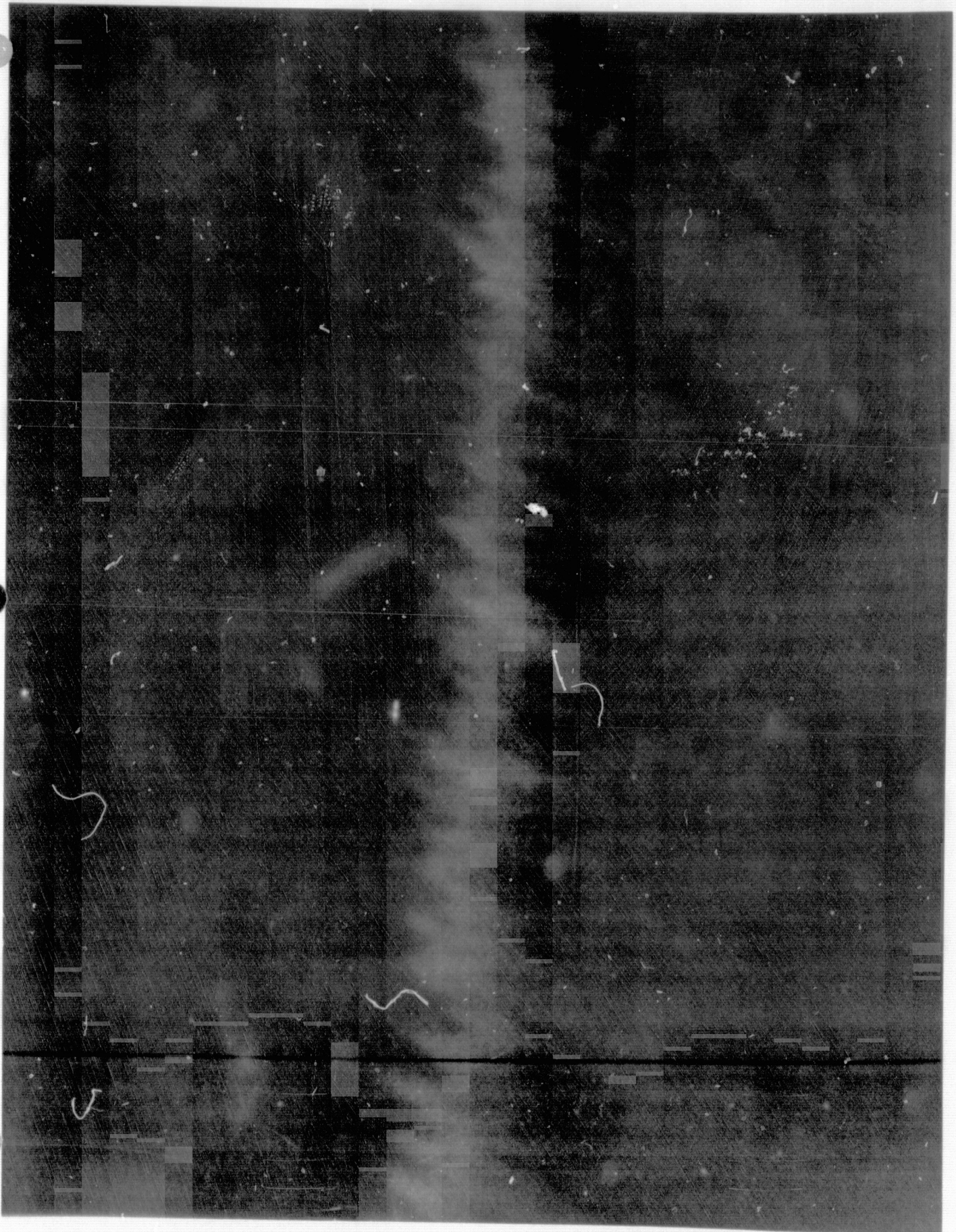
Secchi Depth: 3.25 m 0955

¹Iron in suspended solids

²Without salt correction

³With salt correction

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ID 90

0953

18

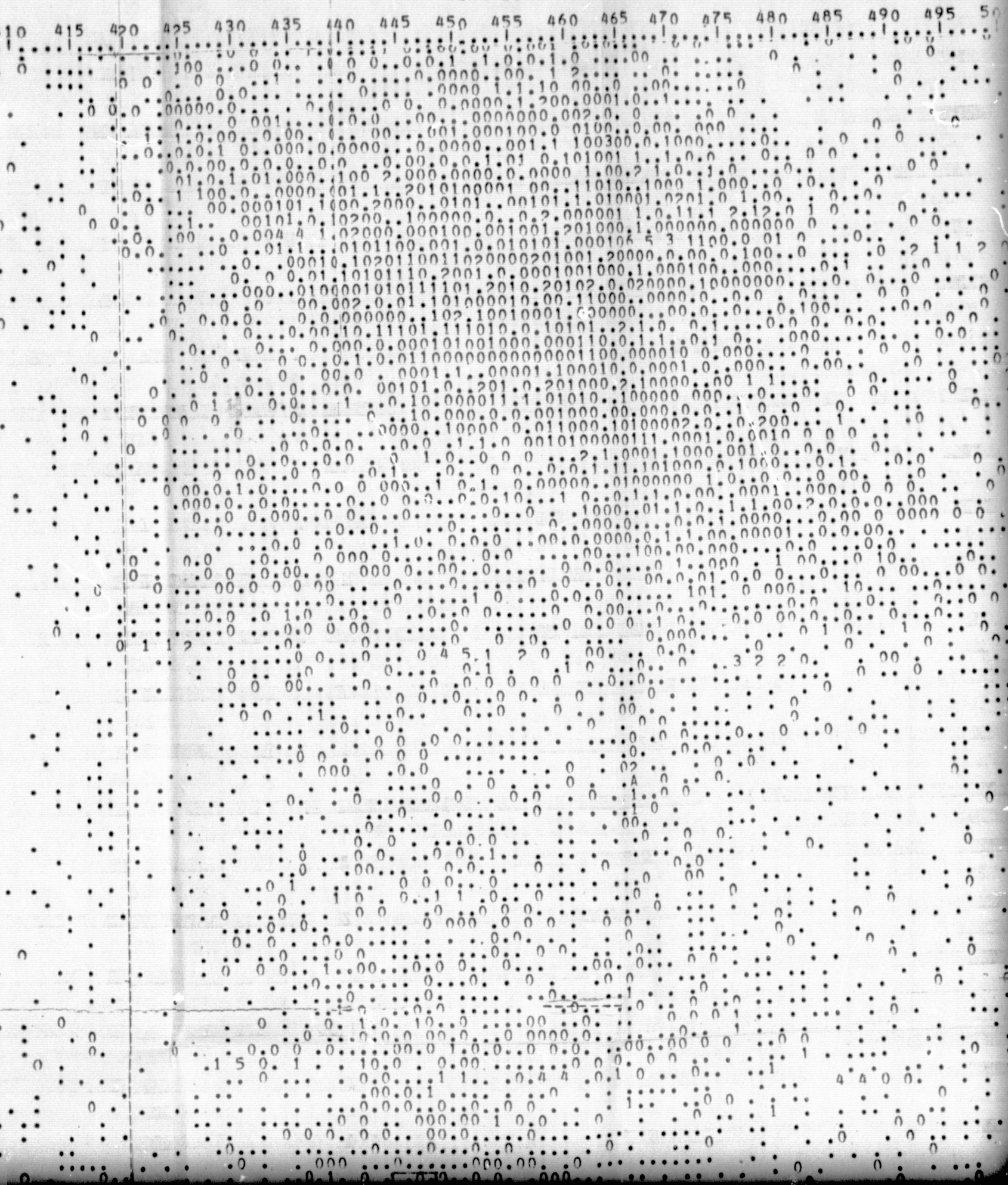
1-1B

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RENDIX M2S, 28 AUGUST 1975
BACKGROUND LEVEL = 040
BAND = 5

SCAN LINE BEGIN = 0001
SCAN LINE END = 0400

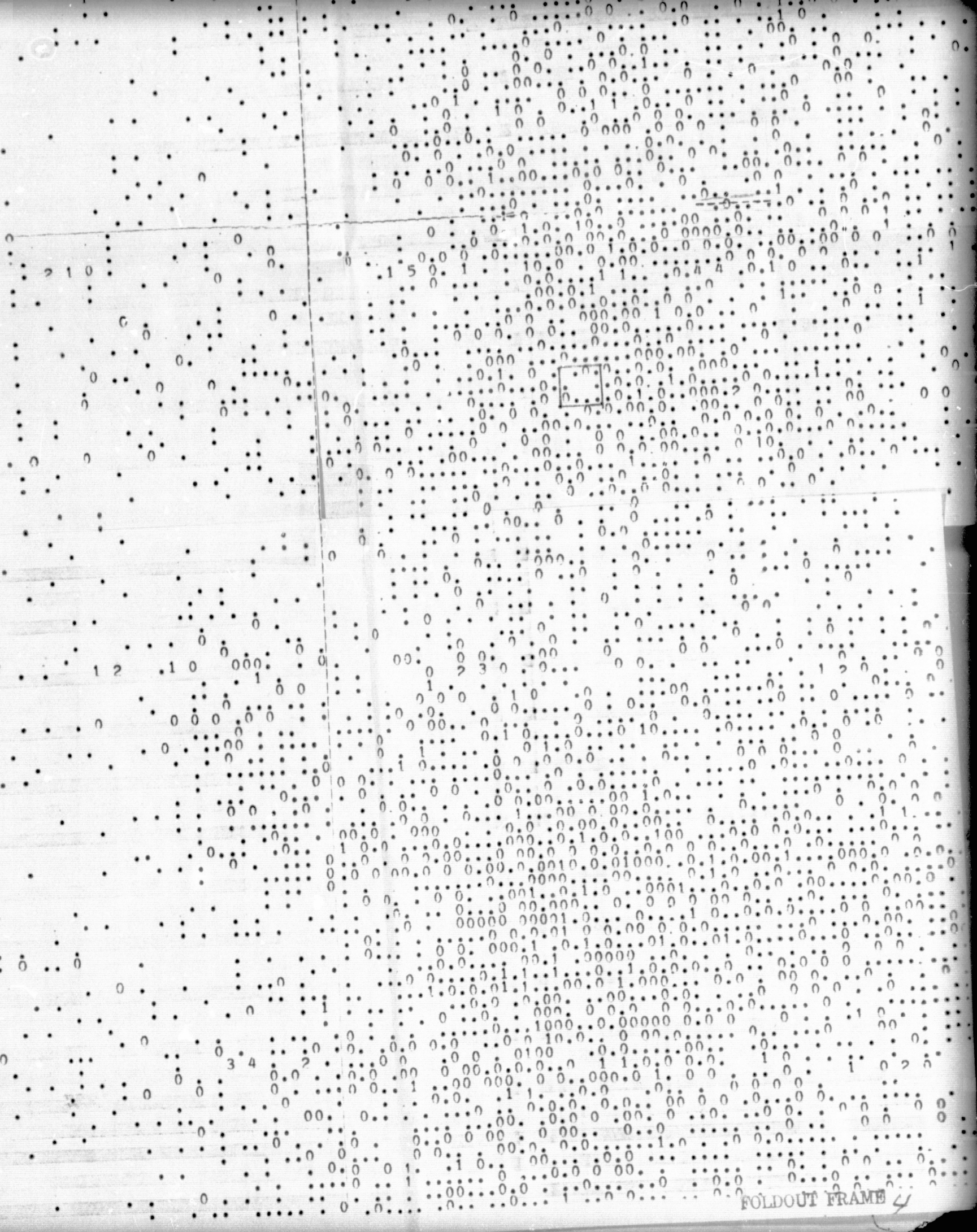
PIXEL # BEGIN = 0
PIXEL # END = 50



7
2R9
747
5H4
4N9
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573
803
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DOUT FRAME

75
2R9
747
5H4
4N9
431
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573
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NG7
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21
00
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Date 8/28/75

STATION 1-2

Location: 38°33.7'N-74°24.4'W
(52182.0/70389.1)

Description: Clear water station in NW
corner M²S 1003 ID 86

Time: 1000-1020
Sun Angle: 1010/θ = 42°50'
Wind Speed: 15 knots
Wind Direction: 015°
Wave Height: 2 1/2'
Surface Temp.: --
Weather: Clear

Hydrocast:

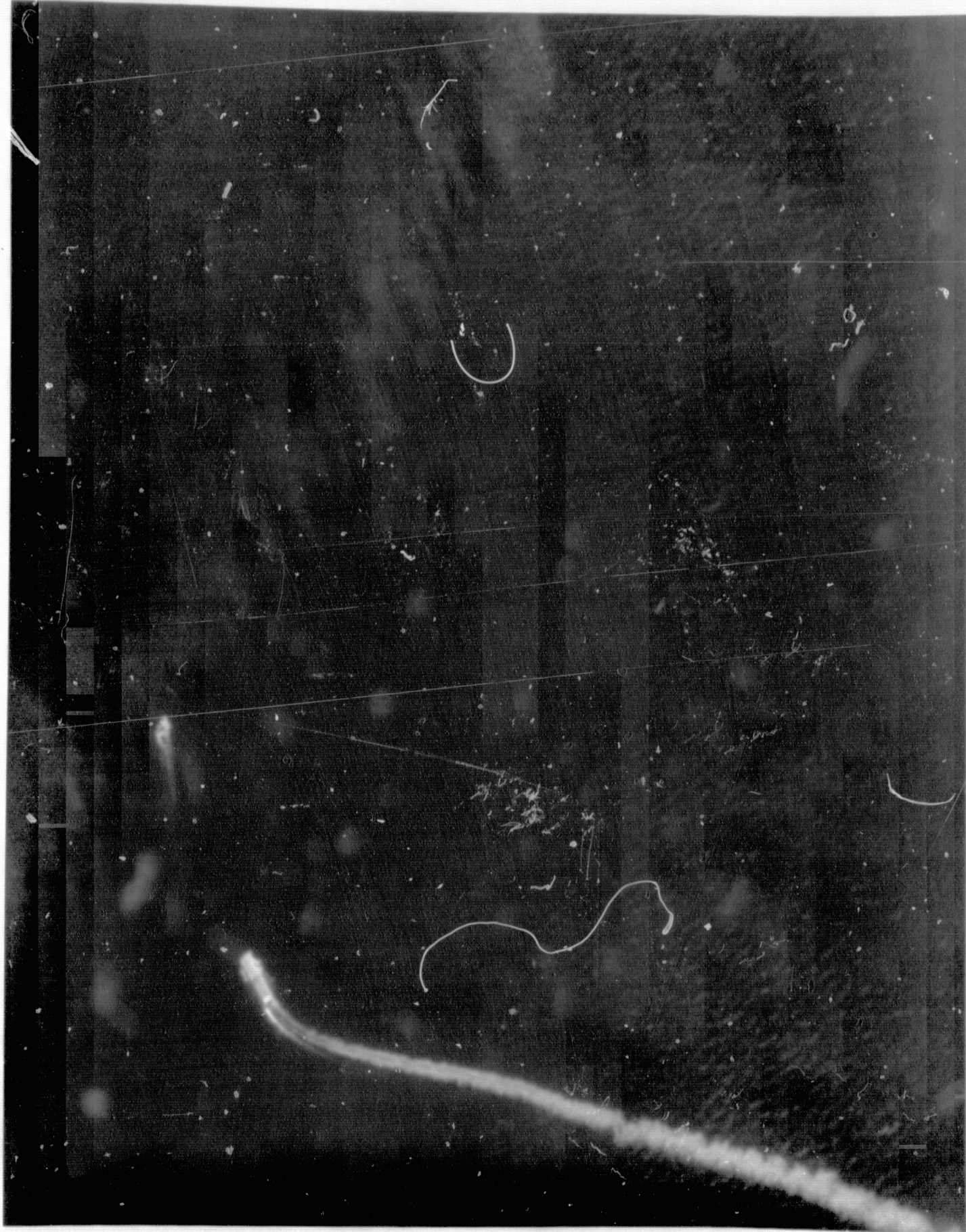
Time	Depth m	pH	S ‰	Fe ¹ mg/l	Chlα μg/l	Seston Weight (mg/l)		Delaware		Total ³	% vol ³
						NASA Total	% vol	Total ²	% vol ²		
1008	Surface	8.1	32.2	<.05	1.5	3.7	43.2	9.53	28.2	4.65	57.8
	2	--	--	--	1.5	--	--	4.73	39.4	2.99	62.6
	4	8.1	32.2	<.05	1.1	1.1	27.3	5.95	33.5	3.81	57.9
	8	8.1	32.2	<.05	1.5	8.1	54.3	3.53	36.5	1.65	77.7

Secchi Depth: 4.25 m

¹Iron in suspended solids

²Without salt correction

³With salt correction



ID 86

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ID 86

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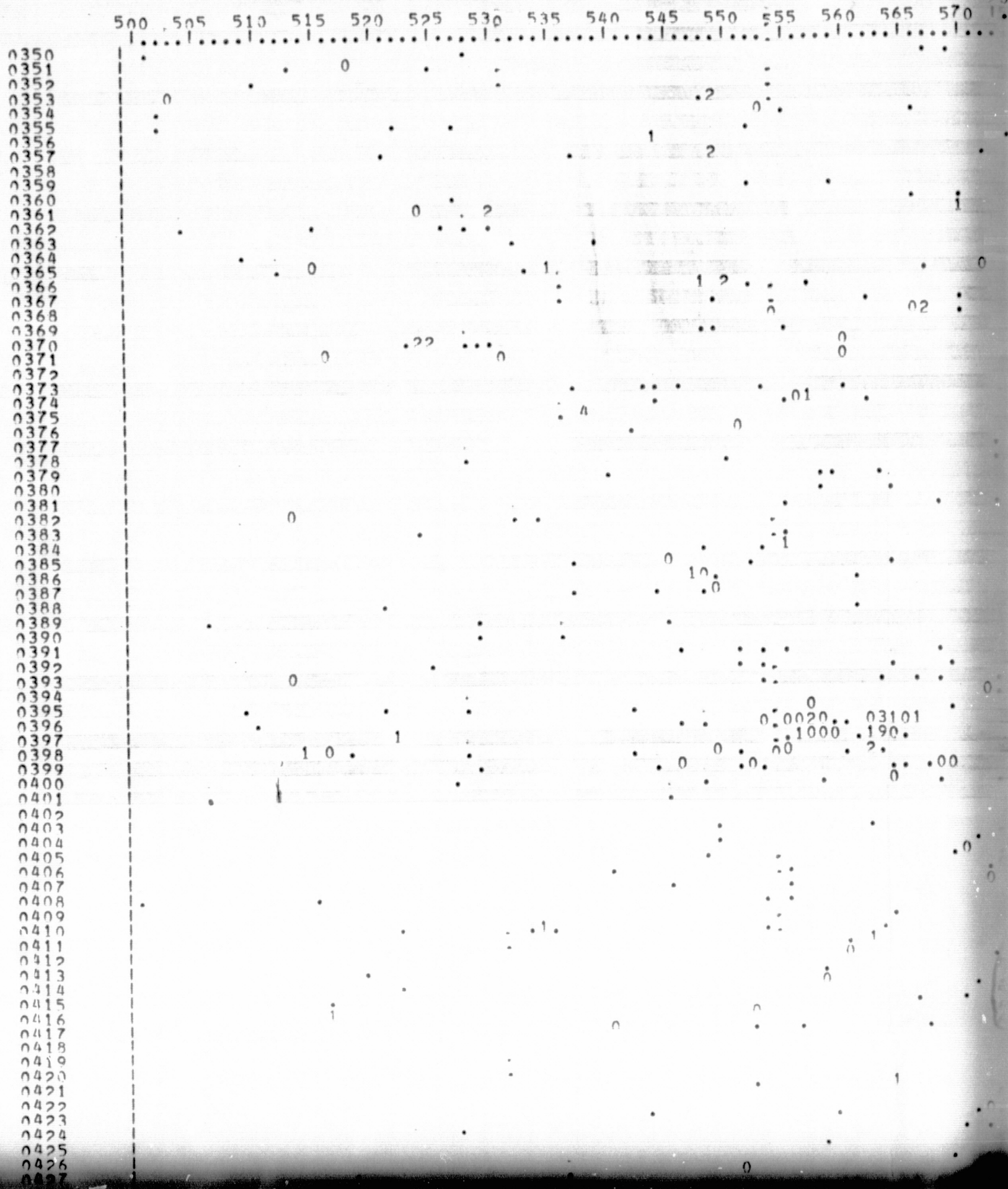
1003

STATION 1-2

RENDIX H2S, 28 AUGUST 1975
BACKGROUND LEVEL = 065
INTERVAL = 5
RANGE = 5

SCAN LINE BEGIN = 0350
SCAN LINE END = 0470

PIXEL #	REG
PIXEL #	END



FOLDOUT FRAME 3

FOLDOUT FRAME

FOLDOUT FRAME

Date 8/28/75

STATION 2-1

Location: 38°31.2'N-74°24.0'W
(42202.8/70406.0)

Description: SW Section - diagonal leg
1035 ID 85

Time: 1040-1050
Sun Angle:
Wind Speed: 15 knots
Wind Direction: 030°
Wave Height: 2'
Surface Temp.: --
Weather: Clear

Hydrocast:

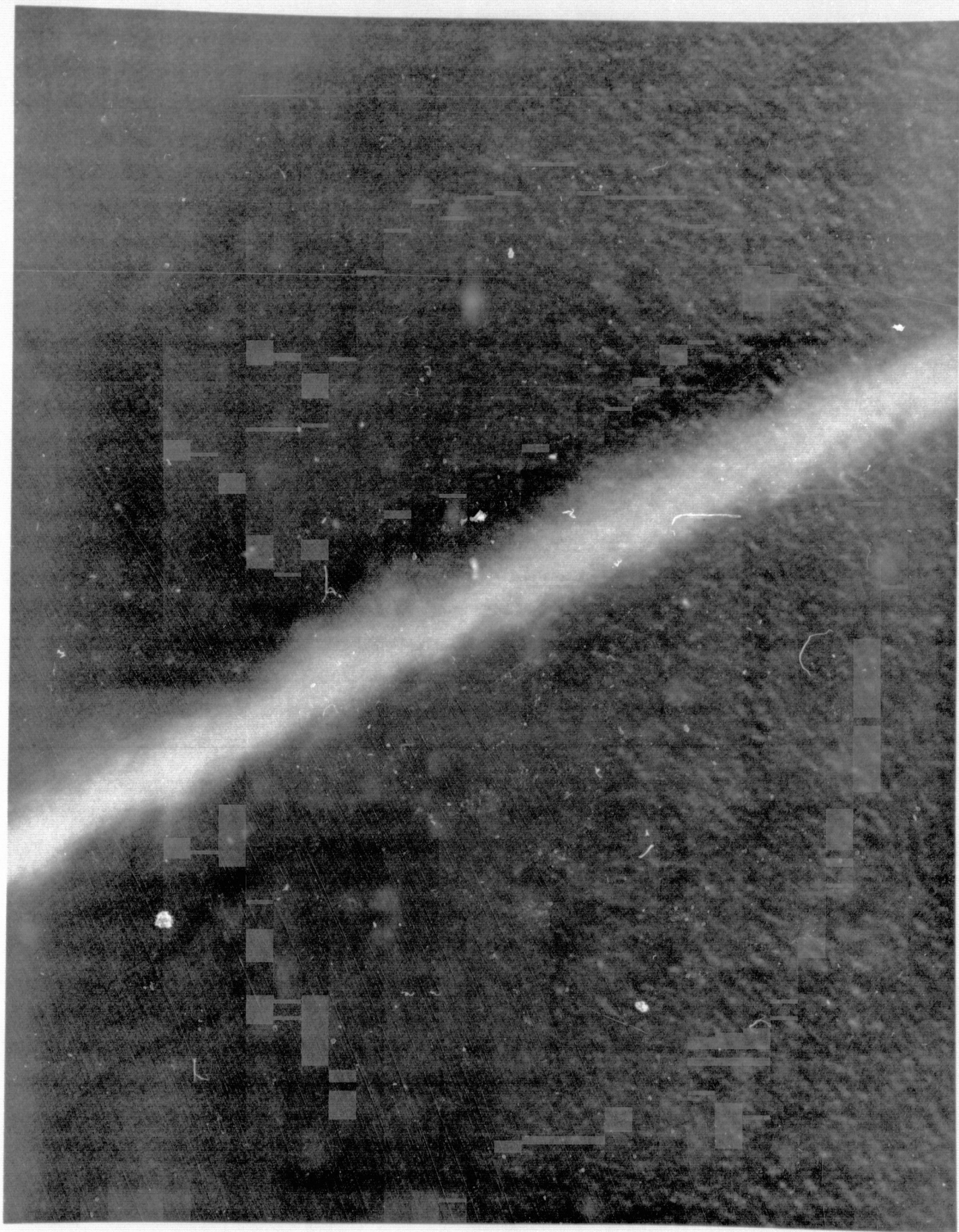
Time	Depth m	pH	S ‰	Fe ¹ mg/l	Chlα μg/l	Seston Weight (mg/l)		Delaware			
						NASA Total	% vol	Total ²	% vol ²	Total ³	% vol ³
1040	Surface	8.0	32.2	0.93	0.99	4.8	56.3	6.75	29.4	6.75	2.94
	2	no sample taken									
	4	8.0	32.2	0.55	1.5	2.8	42.8	5.55	17.8	5.55	17.8
	8	8.1	32.0	0.51	1.9	--	--	8.65	32.9	8.65	32.9

Secchi Depth: 2.75 m

¹Iron in suspended solids

²Without salt correction

³With salt correction



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1035

24

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1D 85

1035

STATION 2-1

BACKGROUND LEVEL = 060
BAND = 5

```
SCAN LINE BEGIN = 0200
SCAN LINE END   = 0600
```

PIXEL
PIXEL

300 305 310 315 320 325 330 335 340 345 350 355 360 365 370

0526
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0581

44

0

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FOLDOUT FRAME 2

350 355 360 365 370 375 380 385 390 395 400 405 410 415 420 425 430 435

25

3B4
057
1CJ
W
1A1
3A3
340
691
DBB

[illegible]

BACKGROUND LEVEL = 060
BAND = 5

FOLDOUT FRAME
0300

SCAN LINE BEGIN = 0001
SCAN LINE END = 0400

PIXEL # BEGIN = 0300
PIXEL # END = 0519

[illegible]

Date 8/28/75

STATION S 2-2, 2-3

Location: Between Stations
2-1 and 3-1

Description: Running Surface Samples.
Samples collected in a plastic
bucket while running through plume
M2S 1053 ID 83, 1057 ID 82

Hydrocast:

Time: 1050-1055

Sun Angle:

Wind Speed: --

Wind Direction: --

Wave Height: --

Surface Temp.:

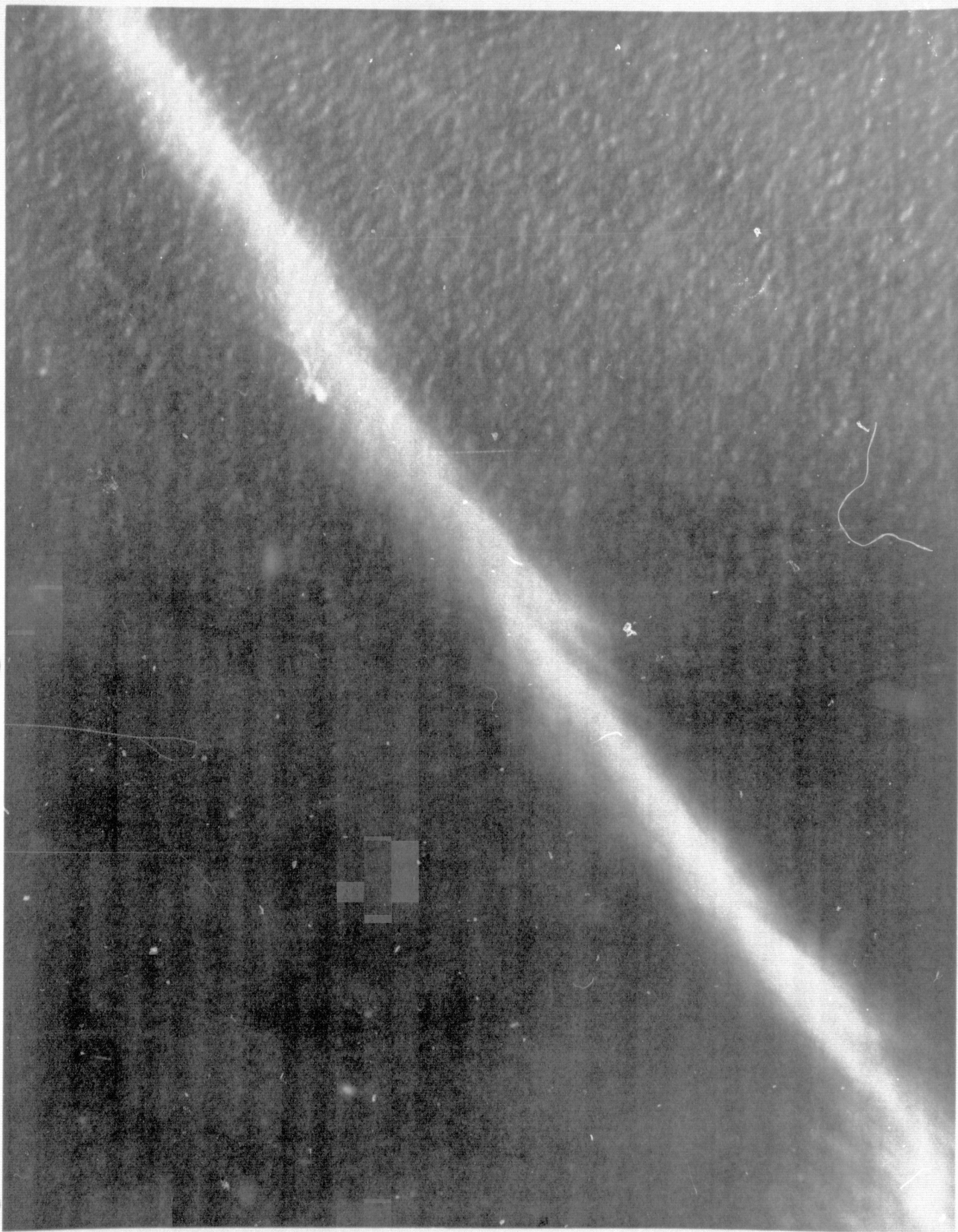
Weather: --

<u>Time</u>	<u>Sta- tion</u>	<u>pH</u>	<u>S ‰</u>	<u>Fe¹ mg/l</u>	<u>Chlα μg/l</u>	<u>Seston Weight (mg/l)</u>		<u>Delaware</u>		<u>Total³ % vol³</u>	
						<u>NASA Total</u>	<u>% vol</u>	<u>Total²</u>	<u>% vol²</u>	<u>Total³</u>	<u>% vol³</u>
1050	2-2	7.8	32.2	1.96	1.6	15.1	62.9	8.15	33.7	6.73	40.8
1055	2-3	7.7	32.1	2.32	1.5	14.3	63.6	8.70	35.2	8.14	37.7

¹Iron in suspended solids

²Without salt correction

³With salt correction



ID 83

1053

27

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ID 83

1053

STATIONS 2-2, 2-3

RENDIX M2S, 28 AUGUST 1975

BACKGROUND LEVEL = 060

INTERVAL = 5

BAND = 5

SCAN LINE BEGIN = 0200

SCAN LINE END = 0320

PIXEL # BEGIN

PIXEL # END

450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 5

0200

0201

0202

0203

0204

0205

0206

0207

0208

0209

0210

0211

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0228

0229

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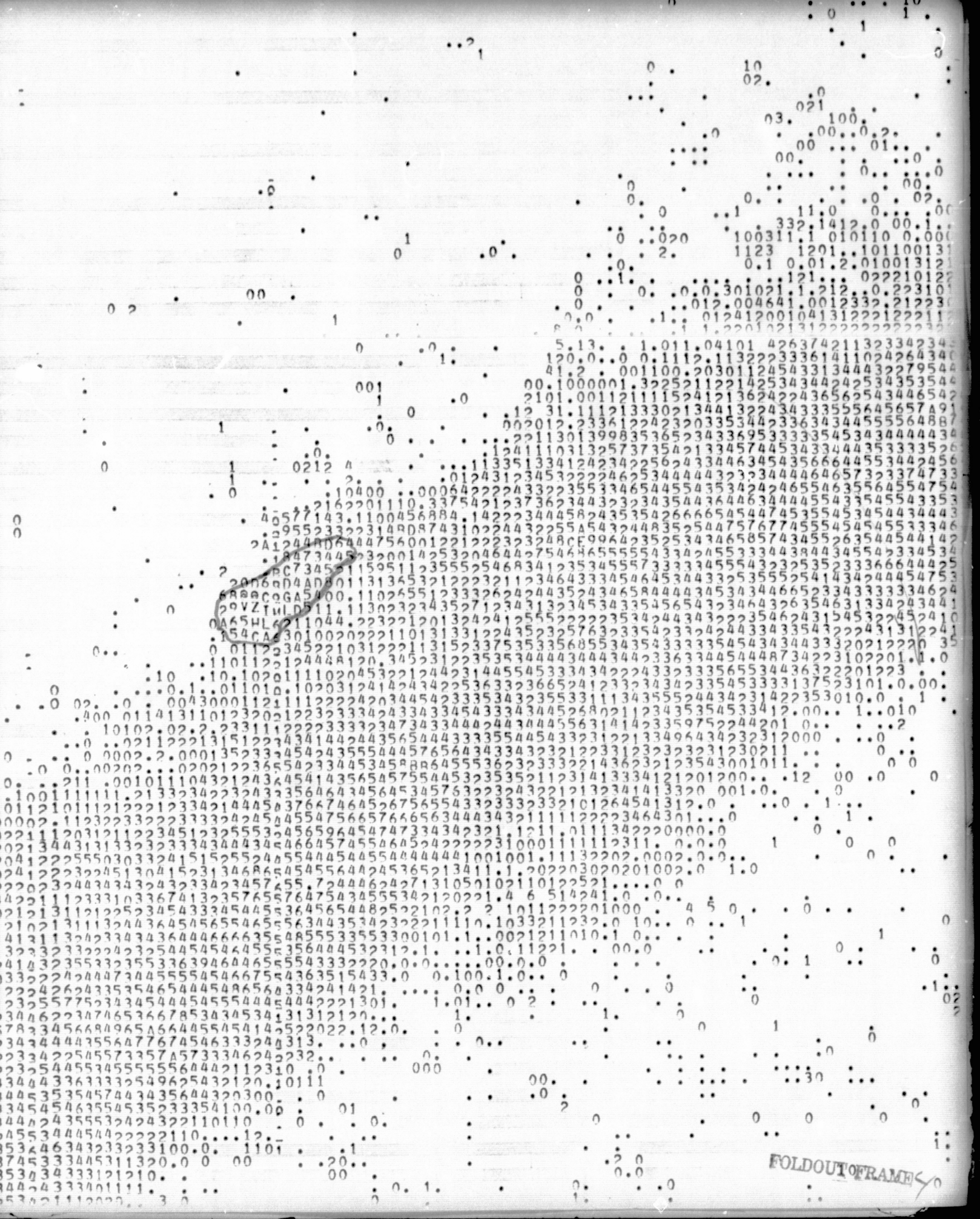
FOLDOUT FRAME 2

PIXEL # BEGIN = 0450
PIXEL # END = 0569

5 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565

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FOLDOUT FRAME 2



FOLDOUT OF FRAME



ID 82

1057

29

ORIGINAL PAGE IS
OF POOR QUALITY

Date 8/28/75

STATION 3-1

Location: 38°30.6'N-74°26.0'W
(52221.0/70405.8)

Description: SW corner - West leg
M2S 1100 ID 81
1105 ID 80

Time: 1100-1125
Sun Angle: 1110/θ = 52°20'
Wind Speed: 15 knots
Wind Direction: 030°
Wave Height: 2.5-3' white caps
Surface Temp.: --
Weather: Clear

Hydrocast:

Time	Depth m	pH	S ‰	Fe ¹ mg/l	Chlα μg/l	Seston Weight (mg/l)					
						NASA		Delaware			
						Total	% vol	Total ²	% vol ²	Total ³	% vol ³
1100	Surface	8.0	31.8	0.78	1.9	5.6	58.9	6.08	42.6	2.20	92.6
	2	no sample taken									
	4	8.0	32.0	1.06	1.5	4.7	57.4	5.86	38.3	3.47	64.7
	8	8.0	32.2	0.88	1.8	5.6	58.9	11.00	30.9	7.28	46.8

Secchi Depth: 3 m

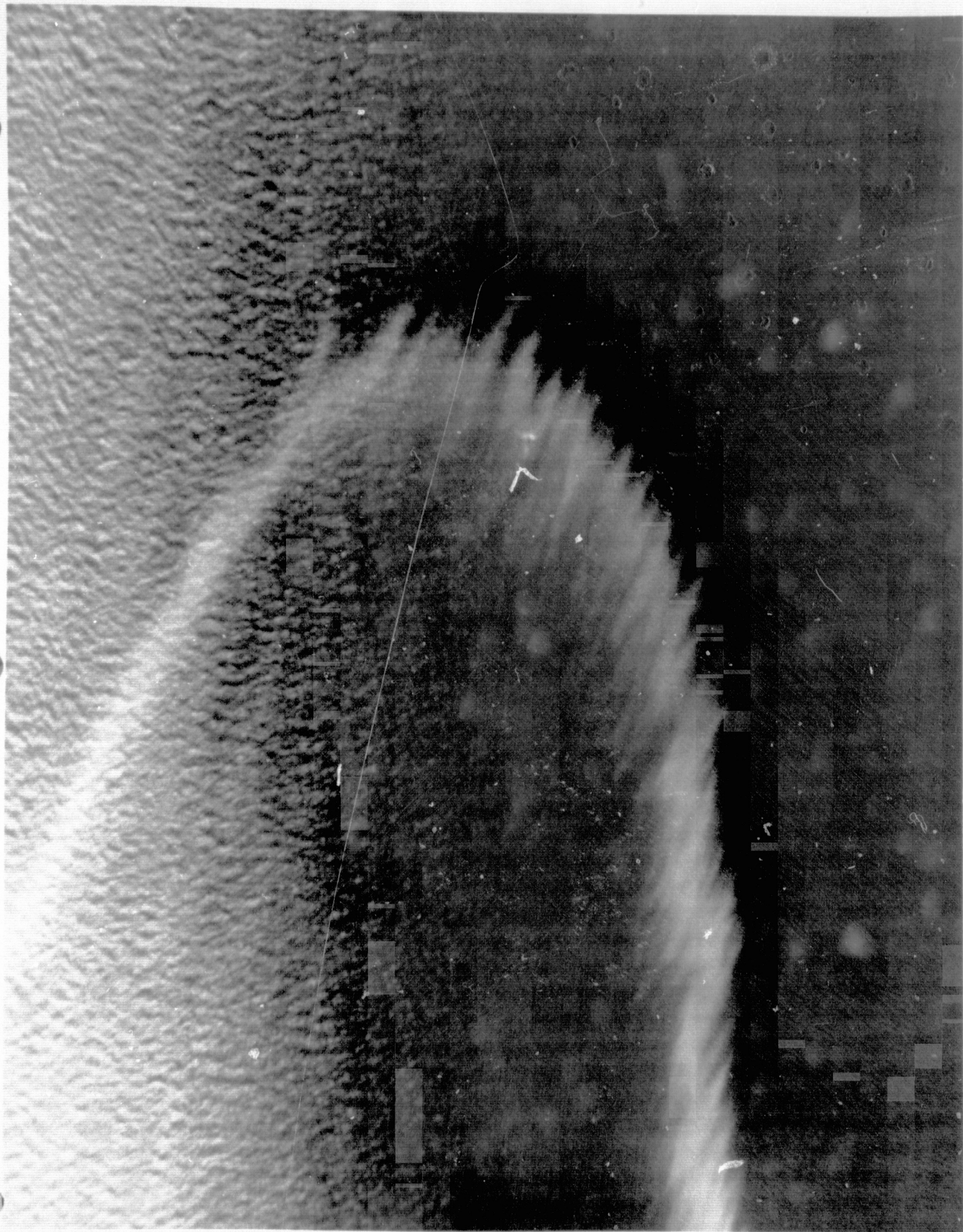
RPMI Measurements: Time 1110 ERTS pass 1118
- Bands are equivalent to ERTS bands

Band	H _{sky} mw/cm ² -μ	H _t mw/cm ² -μ	N _w mw/cm ² -μ-ster	H _t - sensor (cosine response) directed upward H _{sky} - same as H _t but shaded from the sun N _w - sensor fitted with light tube and directed at the water
4	.001	115	.00015	
5	.00042	98	.0005	
6	.00016	90	.00022	
7	.00007	57	.00007	

¹Iron in suspended solids

²Without salt correction

³With salt correction



ID 81

1100

31

ORIGINAL PAGE IS
OF POOR QUALITY

OLDOUT FRAME

ID 82
1057
STATION 2-3

SENTRY 42S, 28 AUGUST 1975
BACKGROUND LEVEL = 060
INTERVAL = 5
RANGE = 5

SCAN LINE BEGIN = 0340
SCAN LINE END = 0440

PIXEL # BEGIN
PIXEL # END



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00101132244354435533
00101001224453324343322
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00101010135252355342243421
0010111121343545354452322432
0010100114252334725213243222
00101111211324433443322212
00101111221232344433342312001
00101001211030343334242222122
00012121212303343522332212121
00001211011232334344331222411
00102121323352455332332122210
00124322122244224546331331202
001211232222243445344432201121
00222132331524353443445332111110
00234332224332255442322110
0023122534323352423324121101200
00233333252523342423322011100
002113152543334243423122010200
0022222254336762422111000
001122244142354424532321111
00221222432333422220121200
001012223433313440101210
00001213335344444142220021000
0000121323543343133221221000
001122223354344322322031200
00112222424224424232221001210
000001243313335443523442224100
0010222352434565242244222200
0012234424445423342231200
001123524344552422233211101
00111543434454555534233131300
0011235444533635432333121310
00032225544423355414012303002
00122221335433525237221204121
00122221124543344535633233020110
00122221124343543331232103100
001222211244253443324122210101
00111222112322332222200100
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001223314345444453333133301220
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0002222133555254553241523120201
0002244433336344255162133312232200
00111133555124455322343220120
00103333335533344443322131222
00122225543355522233212330100
001434355444544444721331212102
00112333343554234321111152000
0011231335352354432222111042010
00122354353344323402120020
00122423555633465343224120111
00113434444142533233212230
001232544433555454241111231
001334523225526441131111007
0012353325454435333341102023
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001134541441552132433122110100
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003434365464536334331101010
00346465354574334222001000
0034666534175372312111000
005434444444301120011000
00354455444564331422101001
00543545345432222101000
00545534535323121100000
00542443532222222221000
0034554532335421000301100
0044444454321332222001100
005544343423212531200000
003443452223222111100000

FOLDOUT FRAME 4

OLDOUT FRAME /

ID 81

1100

STATION 3-1

BENDIX M2S, 28 AUGUST 1975

BACKGROUND LEVEL = 060

INTERVAL = 5

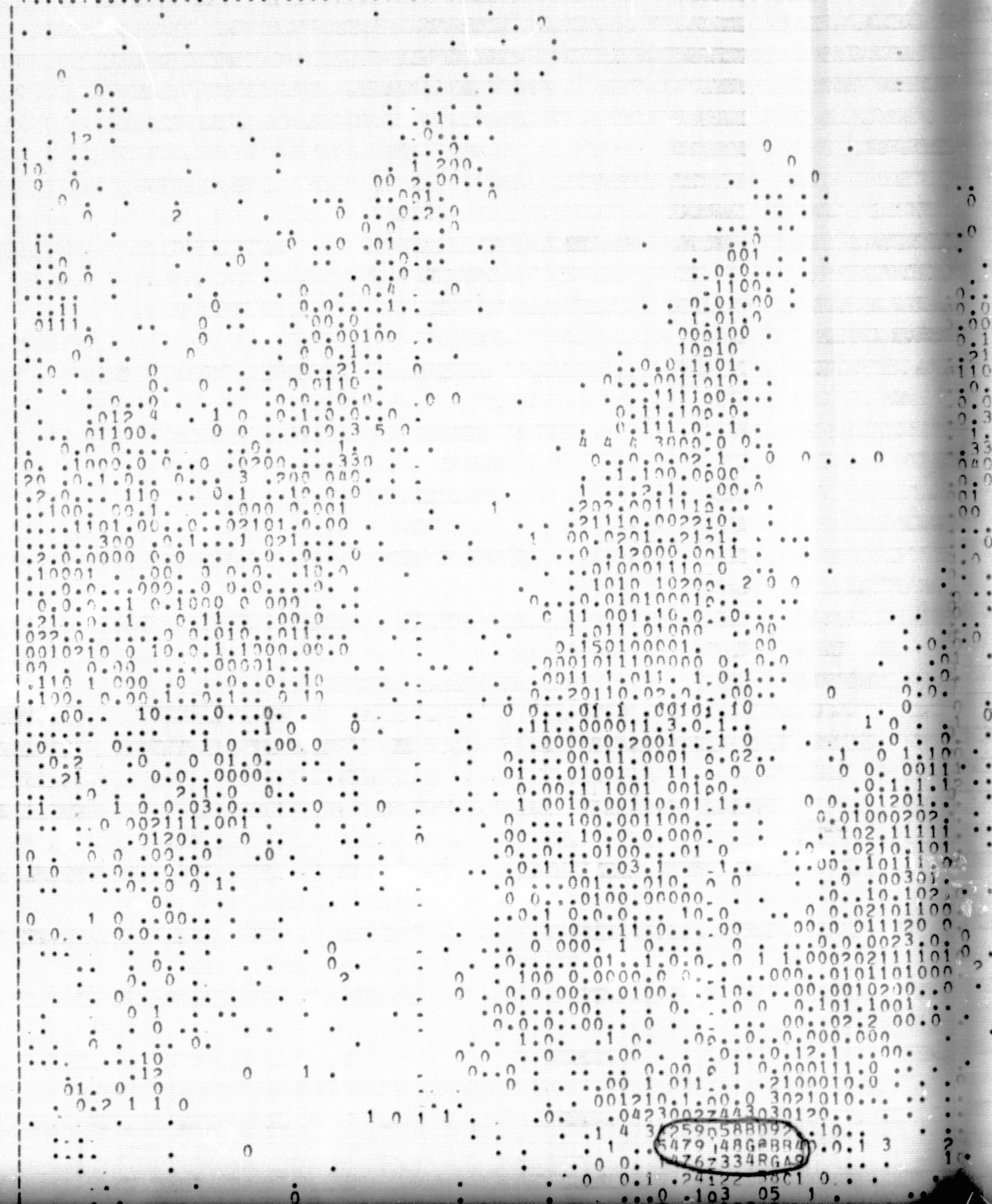
BAND = 5

SCAN LINE BEGIN = 0150
SCAN LINE END = 0250

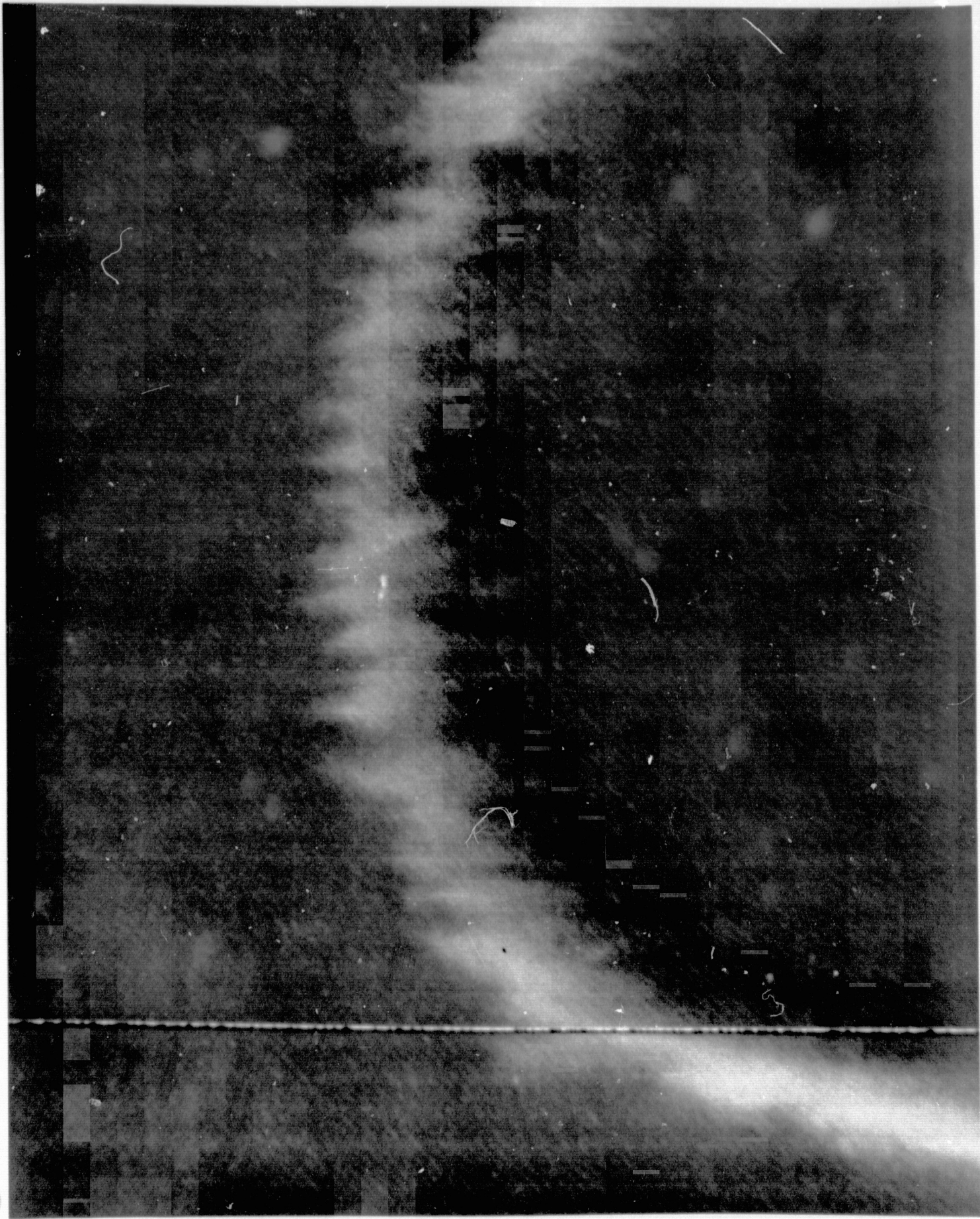
PIXEL # BEGIN
PIXEL # END

400 405 410 415 420 425 430 435 440 445 450 455 460 465 470 475

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FOLDOUT FRAME 4



ID 80

1105

34

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[illegible]

0.0.1032312011
0.000.10200211100
1.10.13220013000000001
0.0.1120010021000.00
0.0.000202.0.10.0.0
0.0.0000.000.2
0.11.000.1.0
10.00.0.00.2.2
0.0.000.1.02.0.0
0.0.0.0.20.0.0
1.0.00000
0.0000.0.0
0.1.1.0.0
0.1.000.
0.0.0.0.001.0.1
0.001.0020.0.1
0.00.20011.0000.1
101.12.1.00.1.0.1
0.01.000.11.0.00.10
0.02.0.00101.0.0.001
0.0.0.200.000.0.01
1.0.1.2.0.2.0.00
0.0.01.
0.0000.0.0
0.010.000
0.0.1.00
0.0100.0.01
0.0.0.0
0.1.0010.
0.0.0.1.0
0.1.11110
0.000.0212.1.1
0.0000.1211000
0.03.10.11412.
0.000.0010.0010201.
0.00.2.11000.0210
2.10.201.0001
0.0.1.1.113.0
0.0.1.0.0.1100
0.0.0.0.0.00
0.0.1.0.110
0.0.0.1.
0.0.0.26
0.000.
1.0.1.1
0.0.10
0.0.00
0.0.0
0.0.1
0.0.1000
0.0.020
0.0.000.0.3
0.0.01200001
2.1102.1.0
01000101020
0.0101.1.101
0.0.001.11
0.0.20100.100.00
0.00011110.01200.0
0.1.22001202.010.00
0.00.21101022000001.0
0.0.001011.0.00
02.121.1.1
2.00.0.1
10.0.0
0.0.0
0.0.0

FOLDOUT FRAME

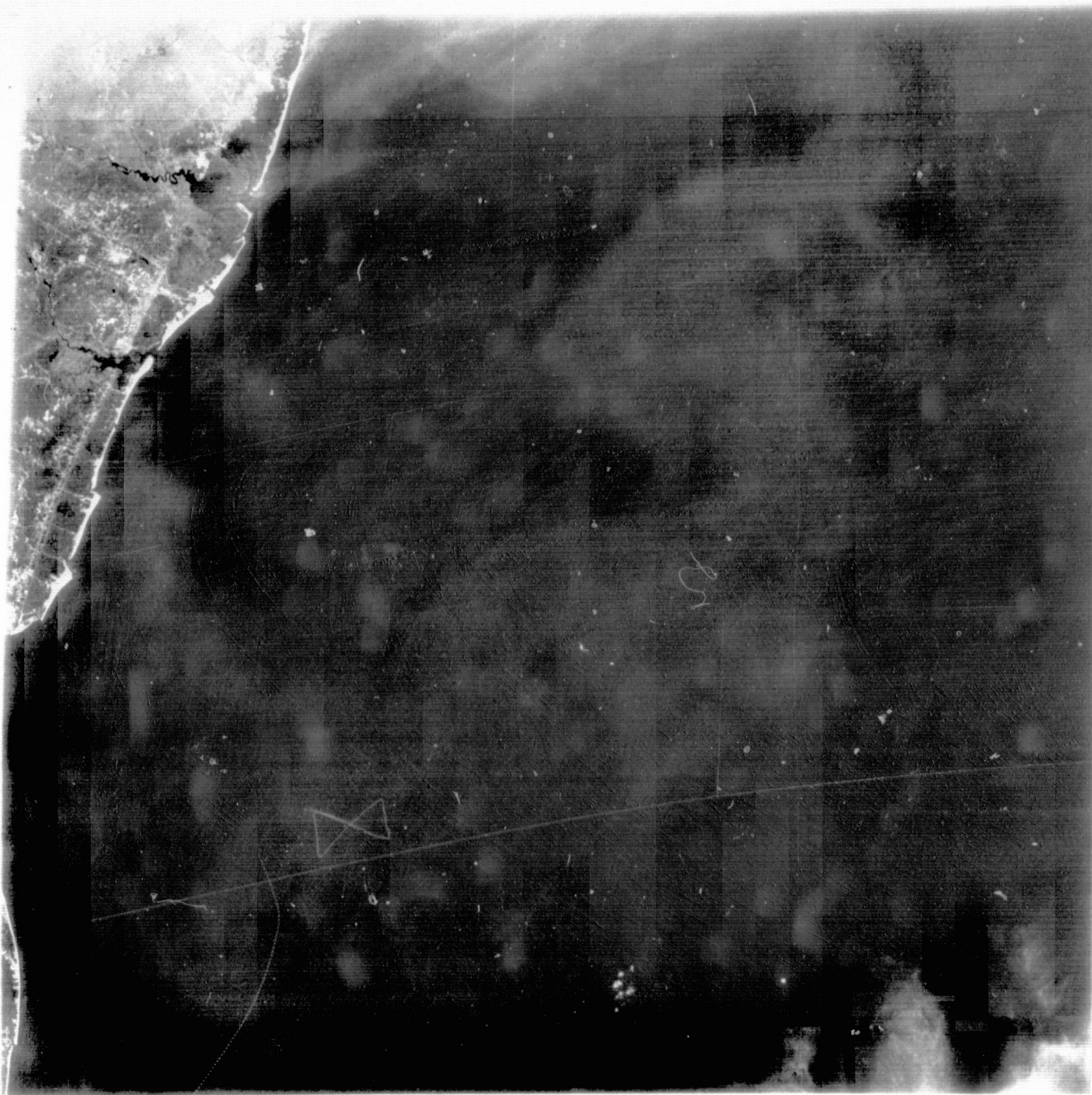
W074-30 W074-001 W073-30 W073-001
28AUG75 C N40-18/W073-23 N N40-17/W073-20 MSS 4 D SUN EL49 AZ130 191-3038-N-1-N-D-2L NASA ERTS E-2218-14545-4 02

W074-30

W074-001

W073-301

W073-001



W075-00 W074-301
28AUG75 C N38-52/W073-52 N N38-52/W073-49 MSS 4

W074-001 W073-30 W073-001
D SUN EL50 AZ128 191-3038-N-1-N-D-2L NASA ERTS E-2218-14552-4 02

W075-00

W074-301

W074-001

W073-301

LANDSAT

1055

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36

VOL

NASA EPTS F2
28 AUG 75

SUN EL/A
ORBIT RM73-5
AQUISIT 073-4

GROUND
BAND



FOLDOUT FRAME 2

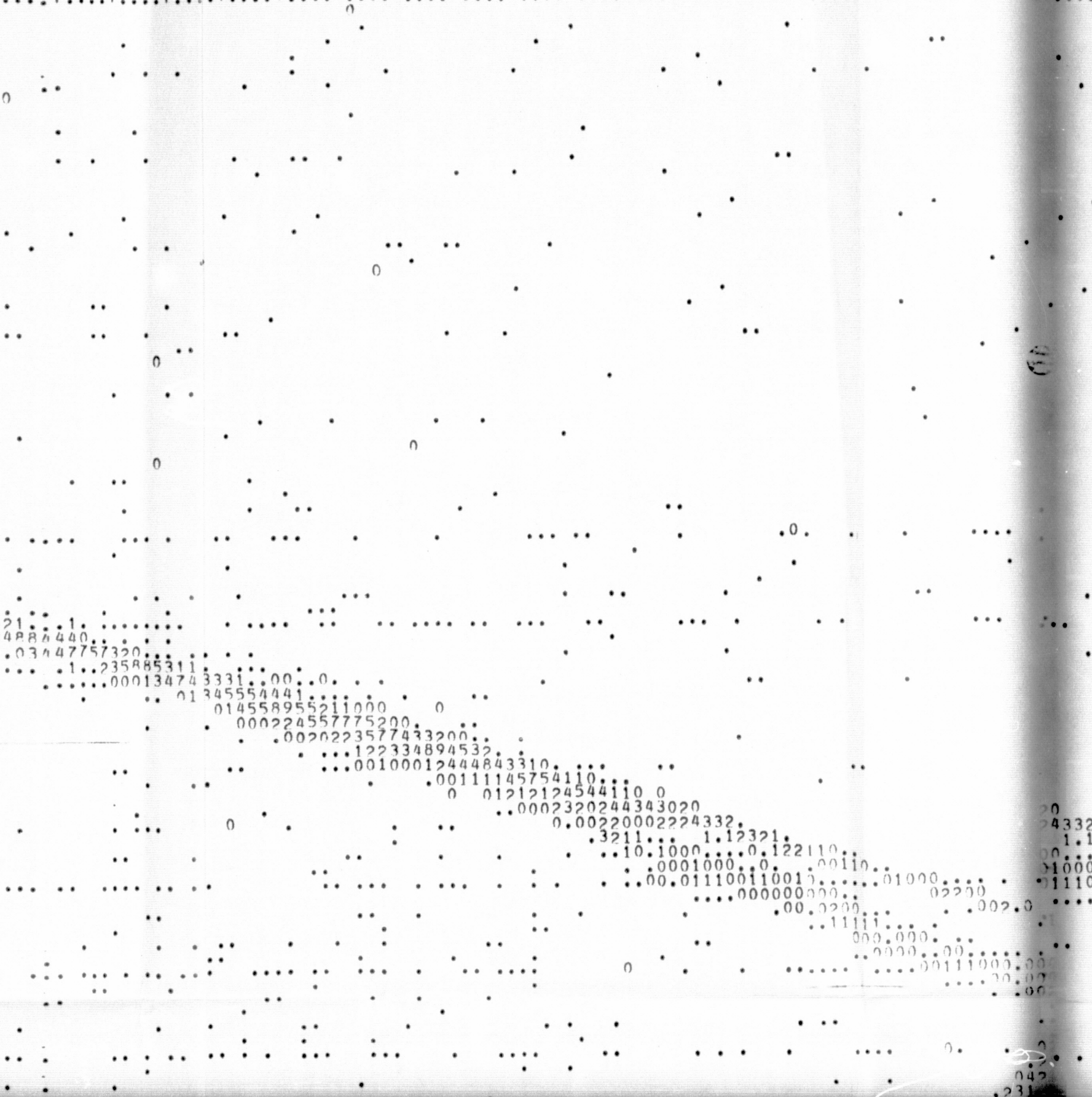
A FRTS F2
8 AUG 75

SIN EL/AZ : 50/128
ORBIT REV. : 3038
ACQUISITION SITE : N

PIC
S/C
S/C

LEVFL = 10
= 5

0 155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 10 2



LANDSAT FOLDOUT FRAME 3

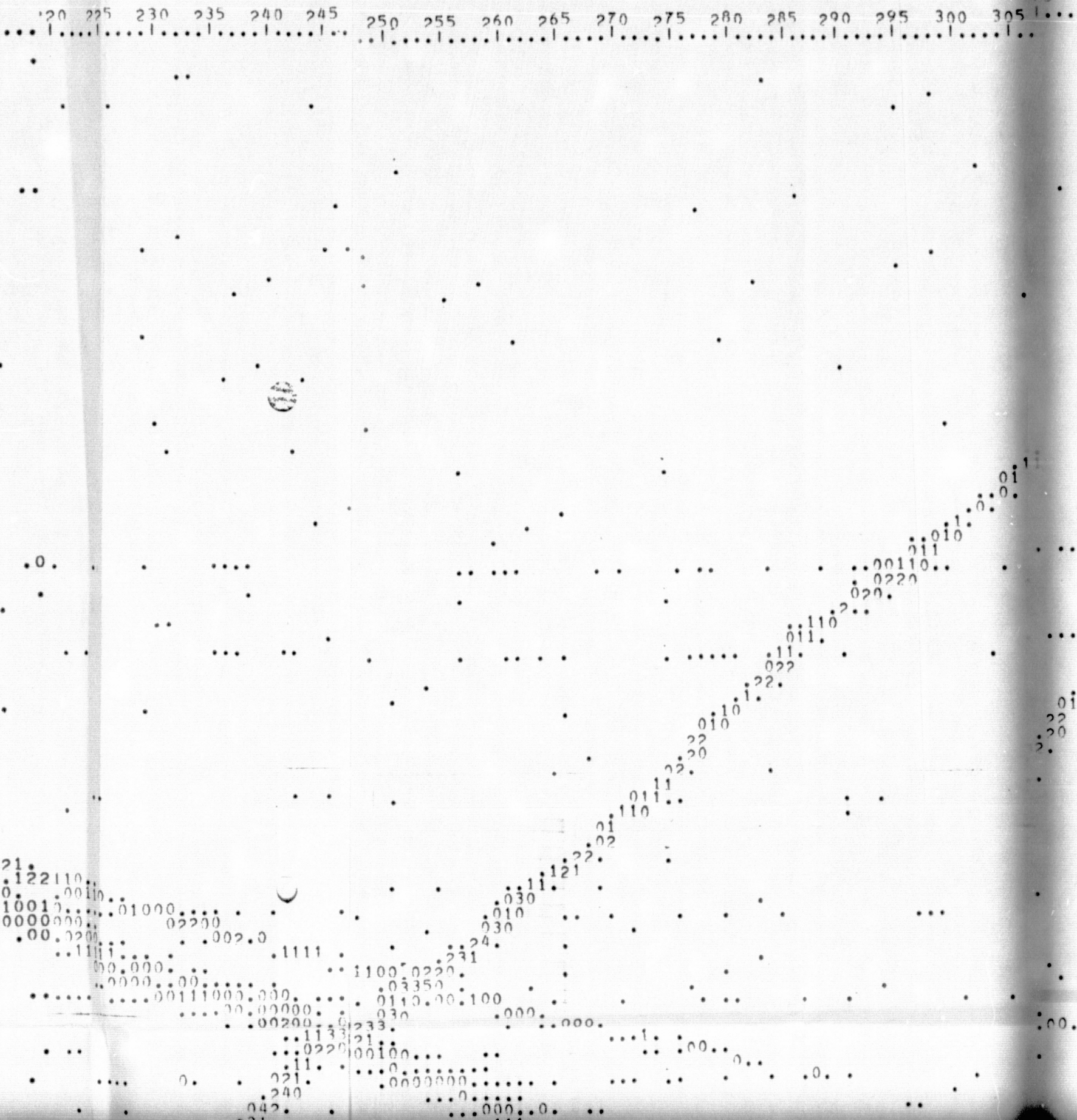
1055

NASA ERTS F2
28 AUG 75

PICTURE CENTER: N38-52 W073-52
S/C LOCATION : N38-52 W073-49
S/C HEADING : 191

SUN EL/AZ : 50/12
ORBIT REV. : 3038
ACQUISITION SITE : N

BACKGROUND LEVEL = 10
BAND = 5



E 4

PICTURE CENTER
S/C LOCATION
S/C HEADING

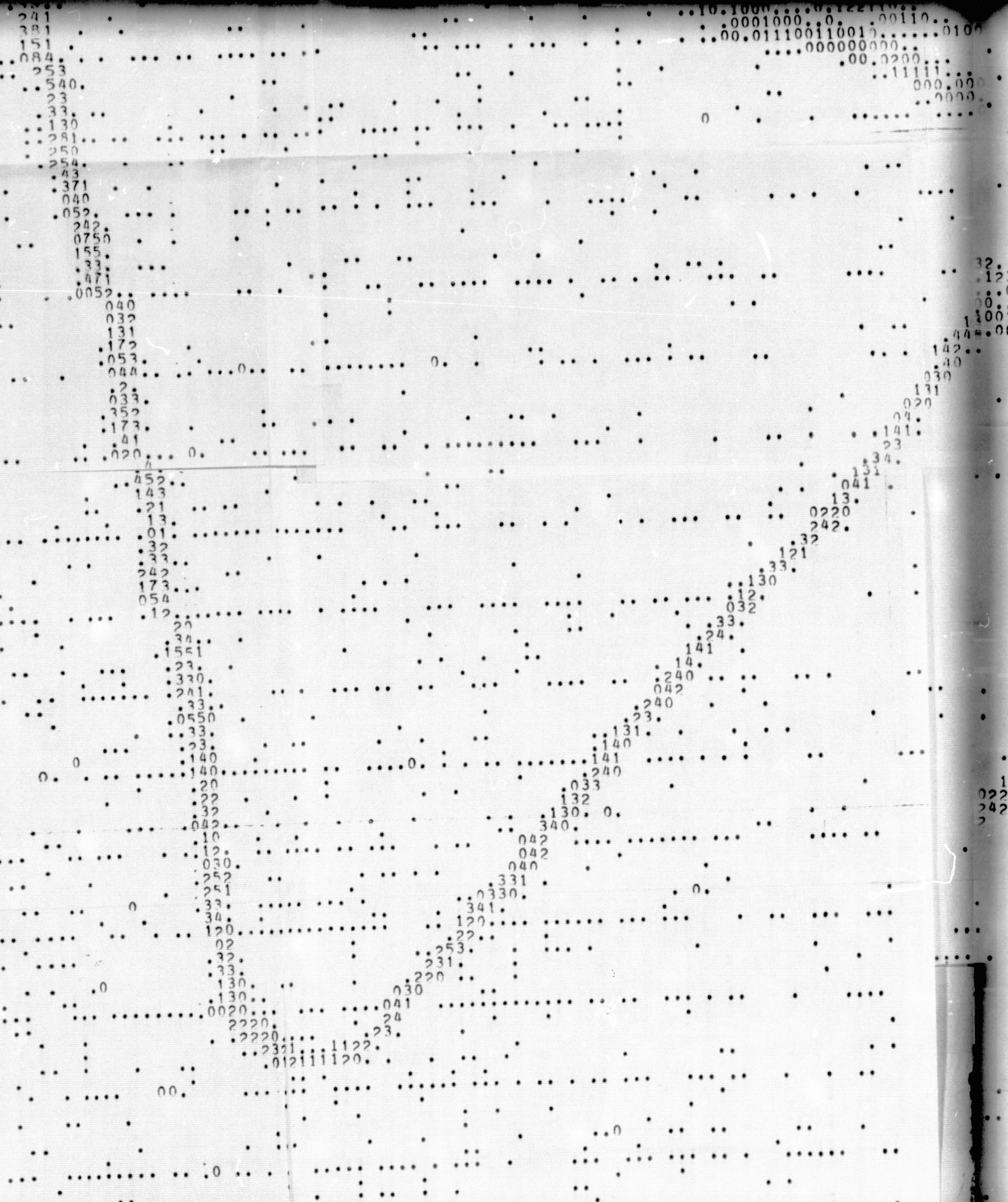
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020

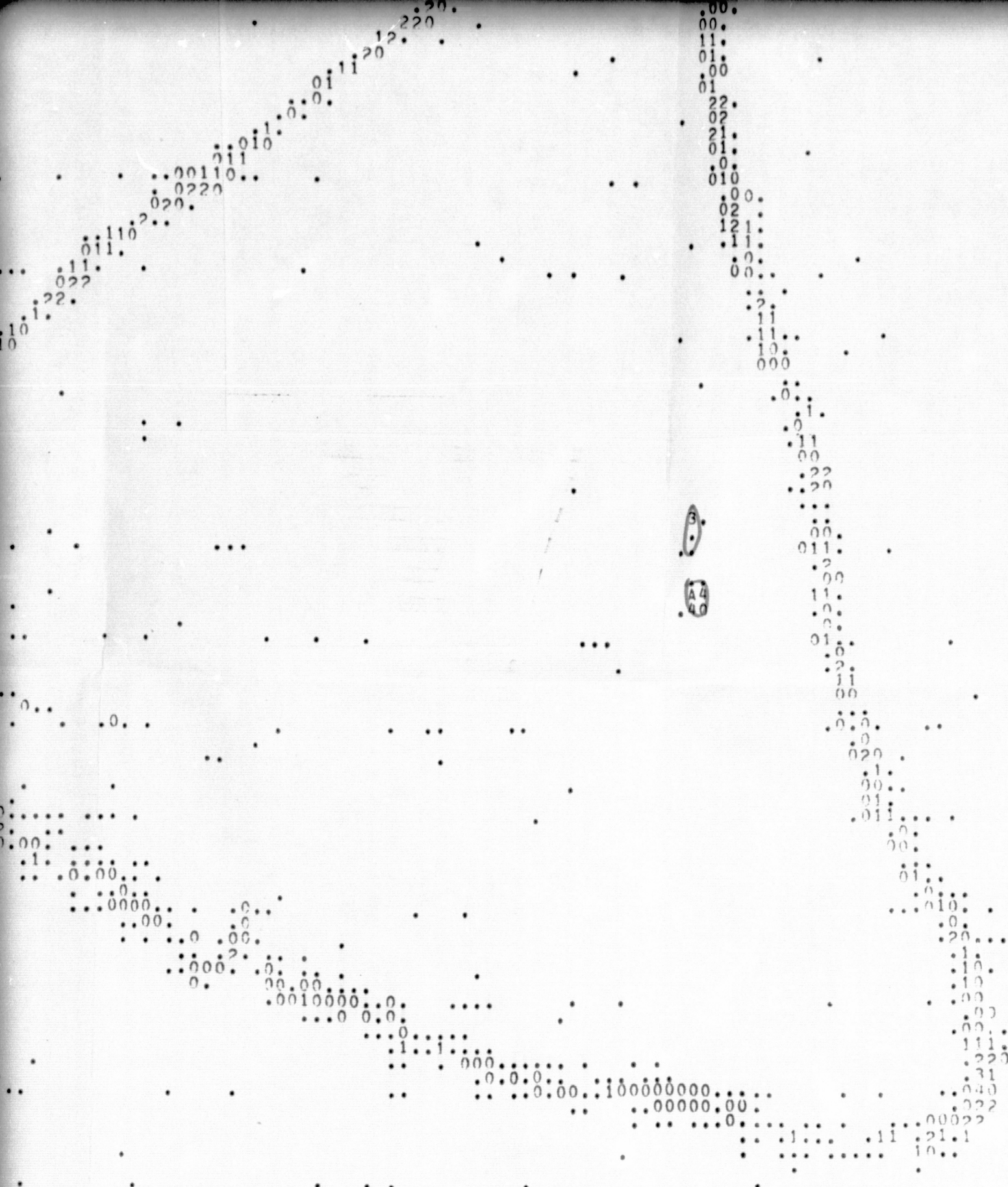
452
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FOLDOUT FRAME

7



3.
A4
40

Date 8/28/75

STATION 4-1

Location: 38°32.3'N-74°27.1'W

Description: Bucket sample only
(Helicopter station)
SW section - western leg

Time: 1230-1235
Sun Angle:
Wind Speed: --
Wind Direction: --
Wave Height: --
Surface Temp.: --
Weather: --

Bucket Sample

Time	pH	S ‰	Fe ¹ mg/l	Chl α μ g/l	Seston Weight (mg/l)		Delaware		Total ³	
					NASA Total	% vol	Total ²	% vol ²	Total ³	% vol ³
1230	8.0	31.8	1.03	1.5	7.5	50.7	6.54	38.6	3.01	84.2

Secchi Depth: --

¹Iron in suspended solids

²Without salt correction

³With salt correction

Date 8/28/75

STATION 4-2

Location: 38°32.6'-74°27.1'W
(70392.5/52213.1)

Description: SW Section - west leg

Time: 1237-1250
Sun Angle:
Wind Speed: 12 knots
Wind Direction: 030°
Wave Height: 2 1/2'
Surface Temp.: --
Weather: Clear

Hydrocast:

Time	Depth m	pH	S ‰	Fe ¹ mg/l	Chla µg/l	Seston Weight (mg/l)		Delaware		Total ³	% vol ³
						NASA Total	% vol	Total ²	% vol ²		
12	Surface	8.0	31.8	0.78	1.9	3.2	40.6	6.21	37.8	3.08	76.5
	2	no sample taken									
	4	8.0	32.0	1.06	1.5	2.1	47.6	6.04	44.2	4.71	56.6
	8	8.1	32.2	0.88	1.8	--	--	6.28	35.8	4.45	54.9

Secchi Depth: 2.25 m

¹Iron in suspended solids

²Without salt correction

³With salt correction

Date 8/28/75

STATION 4-3

Location: 38°32.6'N-74°27.1'W
(70390.8/52210.2)

Description: Bucket sample - helicopter
SW section - west leg
M²S 1251-1254/ID 78-77
@ 13,000 ft.

Time: 1258-1300
Sun Angle:
Wind Speed: 9 knots
Wind Direction: 030°
Wave Height: 2 1/2'
Surface Temp.: --
Weather: Clear

Bucket Sample

<u>Time</u>	<u>pH</u>	<u>S</u> <u>‰</u>	<u>Fe</u> ¹ <u>mg/l</u>	<u>Chl</u> _a <u>µg/l</u>	<u>Seston Weight (mg/l)</u>		<u>Delaware</u>		<u>Total³ % vol³</u>	
					<u>NASA</u> <u>Total</u>	<u>% vol</u>	<u>Total²</u>	<u>% vol²</u>	<u>Total³</u>	<u>% vol³</u>
1258	8.0	31.9	1.08	1.5	7.9	53.2	6.29	34.4	2.66	81.5

Secchi Depth: 3 m

¹Iron in suspended solids

²Without salt correction

³With salt correction

ID 77

1254

41

ORIGINAL PAGE IS
OF POOR QUALITY

Date 8/28/75

STATION 4-4

Location: 38°33.3'N-74°27.2'W
(70390.7/52210.2)

Description: SW section - west leg
M2S 1311 1D 75

Time: 1305-1320
Sun Angle: --
Wind Speed: 9 knots
Wind Direction: 030°
Wave Height: 1.5-2'
Surface Temp.: --
Weather: Clear

Hydrocast:

<u>Time</u>	<u>Depth</u> <u>m</u>	<u>pH</u>	<u>S</u> <u>‰</u>	<u>Fe</u> ¹ <u>mg/l</u>	<u>Chl</u> <u>a</u> <u>µg/l</u>	<u>Seston Weight (mg/l)</u>					
						<u>NASA</u>		<u>Delaware</u>			
						<u>Total</u>	<u>% vol</u>	<u>Total</u> ²	<u>% vol</u> ²	<u>Total</u> ³	<u>% vol</u> ³
1307	Surface	8.0	31.6	1.08	1.2	7.4	54.1	10.54	31.7	5.19	64.5
	2					no sample taken					
	4	8.0	32.1	0.32	1.15	2.4	54.2	7.13	26.3	3.20	58.5
	8	8.0	31.8	0.21	1.5	--	--	8.20	30.4	5.70	43.8

Secchi Depth: 3 m

¹Iron in suspended solids

²Without salt correction

³With salt correction

ORIGINAL PAGE IS
OF POOR QUALITY

1311

STATION 4-4

REFDIX M2S. 28 AUGUST 1975
BACKGROUND LEVEL = 060
INTERVAL = 5
RANG = 5

SCAN LINE BEGIN = 0250
SCAN LINE END = 0369

PIXEL #	BEG	SCA
PIXEL #	END	SCA

[illegible]

0250
0251
0252
0253
0254
0255
0256
0257
0258
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0260
0261
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0270
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0280
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0290
0291
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0295
0296
0297
0298
0299

[illegible]

RENDIX M2S, 28 AUGUST 1975
 BACKGROUND LEVEL = 060
 INTERVAL = 5
 BAND = 5

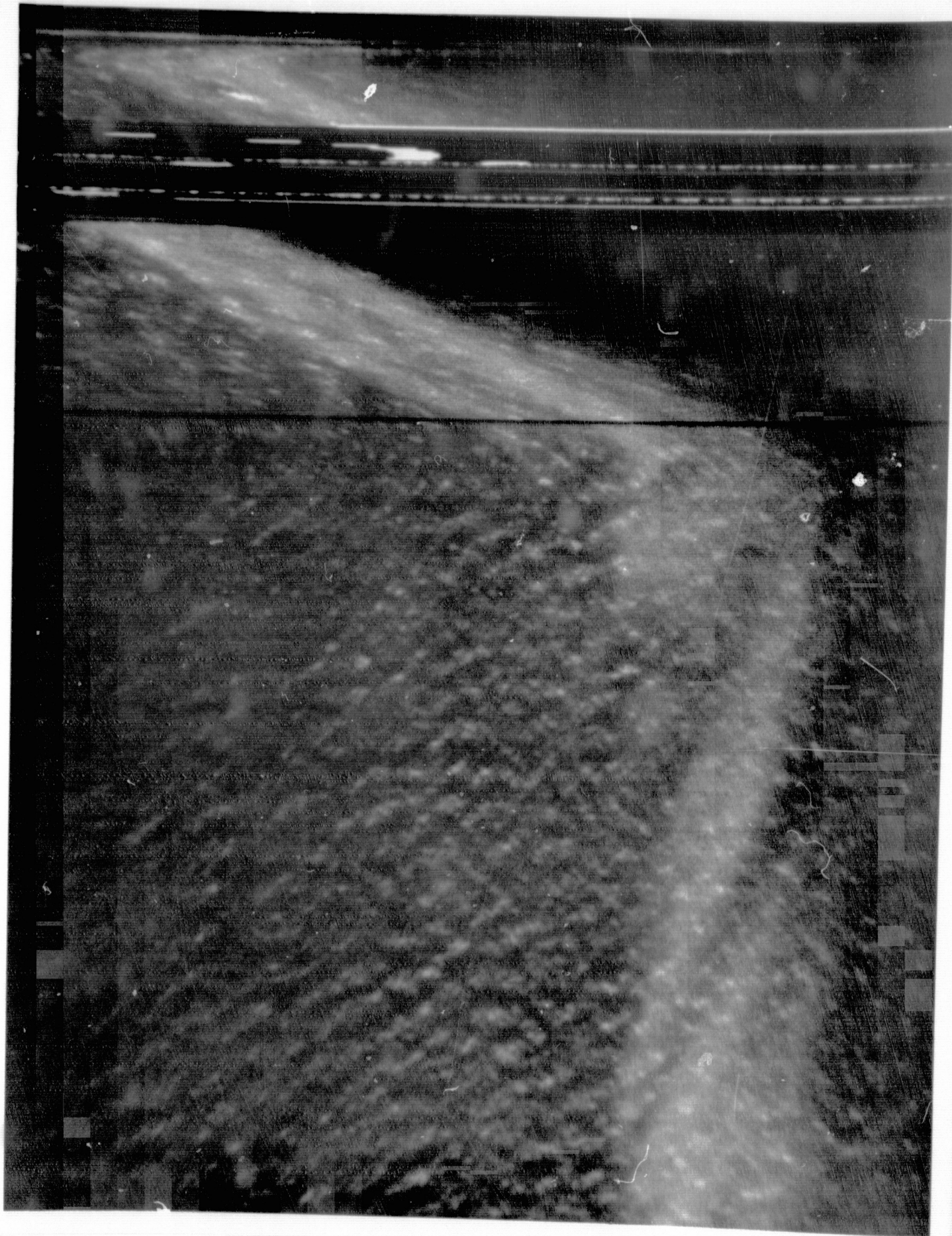
PIXEL # BEGIN = 0230
PIXEL # END = 0349

[illegible][illegible]

00 220
10 103
20 3 035310.03.0.
30 011 215 44004 21233 .10.
0 10437 0 6.010.00.2601 0.. 2 .
0 0 0.35320 201 00.2.2 1 1. .14 .
0 2 00 0 0721.1 0.0.013000110.
006 2 00 0 13.3010.0 1.0.1200 2 0. 0
0 21 04 1000.2 10201.01.1 1 1021 0
201 0.1 0003102 10001130010001111.01420 0 0
01110 0130. 2510. 1301.243113.1.1122020101. 2
204524341102 341 2.1.102501.2 32121131220221311. 0340. 1
2.0004184222300.1023. 230178343.211121343412001344410.0. 2F4.3 20.0.
1022220105580211331.10.1 042.18121122022056412102.22624.23. 33.2. 1
4 21 133253401120020412 .1 3.1120111511503221303221011120302. 0
0 3245656322452 .0102. 1. 2.1067.0 21235003230112111102.421. 1 .00
0022024A82596322111.1.202 .11.0310.016134101323020232103130.
3300002041499344532121201 50.0 .0301. 1101.10321122 32210315231.0.100 .
1204121224123374262402104832100 2 0402.200112121322251312231143211.31.2 00 0 0
.000.0.22202212362216422201023511. 1.1320.12314154122A4301323120302301.2 0 0.. 0. 0
1. 0.1.2.23313232341135674262233101 200000140311324232243535223356312022541. 2 . 3 .
001.0 .2141014435821253201162352012274. 02.12314521343121322433322133242201423.0.
0022024A82596322111.1.202 .11.0310.016134101323020232103130. 11

[illegible]

[illegible]



ID 75

1311

44

ORIGINAL PAGE IS
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Date 8/28/75

STATION 4-5

Location: 38°33.7'N-74°28.7'W
(70386.2/52203.9)

Description: SW section - west leg
M²S 1324 ID 74
1329 ID 72

Time: 1326-1345
Sun Angle: 1336/θ = 58°52'
Wind Speed: 9 knots
Wind Direction: 030°
Wave Height: 1 1/2'
Surface Temp.: 25°C
Weather: Clear

Hydrocast:

<u>Time</u>	<u>Depth</u> <u>m</u>	<u>pH</u>	<u>S</u> <u>‰</u>	<u>Fe</u> ¹ <u>mg/l</u>	<u>Chl</u> <u>a</u> <u>μg/l</u>	<u>Seston Weight (mg/l)</u>		<u>Delaware</u>		<u>Total</u> ³ <u>% vol</u> ³	
						<u>NASA</u>	<u>% vol</u>	<u>Total</u> ²	<u>% vol</u> ²	<u>Total</u> ³	<u>% vol</u> ³
1326	Surface	8.0	31.6	0.70	1.5	5.2	61.5	8.6	47.9	6.59	62.8
	2	no sample taken									
	4	8.0	31.6	0.62	1.6	3.8	50.0	7.10	30.6	6.06	35.8
	8	8.0	31.9	0.51	--	4.8	45.8	--	--	--	--

Secchi Depth: 3 m

BT Cast: 1340

¹Iron in suspended solids

²Without salt correction

³With salt correction



ID 72

1329

2/6

ORIGINAL PAGE IS
OF POOR QUALITY

STATION 4-5

RENDIX M2S, 28 AUGUST 1975
BACKGROUND LEVEL = 060
INTERVAL = 5
RANO = 5

SCAN LINE BEGIN = 0320
SCAN LINE END = 0420

PIXEL #	BEGIN	SCA
PIXEL #	END	SCA

0320 .0 001 00001110
0321 .1 001 001132
0322 .2 001 001100
0323 .0 001 001100
0324 .1 001 001100
0325 .1 001 001100
0326 .1 001 001100
0327 .2 001 001100
0328 .0 001 001100
0329 .0 001 001100
0330 .0 001 001100
0331 .0 001 001100
0332 .0 001 001100
0333 .0 001 001100
0334 .0 001 001100
0335 .0 001 001100
0336 .0 001 001100
0337 .0 001 001100
0338 .0 001 001100
0339 .0 001 001100
0340 .0 001 001100
0341 .0 001 001100
0342 .0 001 001100
0343 .0 001 001100
0344 .0 001 001100
0345 .0 001 001100
0346 .0 001 001100
0347 .0 001 001100
0348 .0 001 001100
0349 .0 001 001100
0350 .0 001 001100
0351 .0 001 001100
0352 .0 001 001100
0353 .0 001 001100
0354 .0 001 001100
0355 .0 001 001100
0356 .0 001 001100
0357 .0 001 001100
0358 .0 001 001100
0359 .0 001 001100
0360 .0 001 001100
0361 .0 001 001100
0362 .0 001 001100
0363 .0 001 001100
0364 .0 001 001100
0365 .0 001 001100
0366 .0 001 001100
0367 .0 001 001100
0368 .0 001 001100
0369 .0 001 001100
0370 .0 001 001100
0371 .0 001 001100
0372 .0 001 001100
0373 .0 001 001100
0374 .0 001 001100
0375 .0 001 001100
0376 .0 001 001100
0377 .0 001 001100
0378 .0 001 001100
0379 .0 001 001100
0380 .0 001 001100
0381 .0 001 001100
0382 .0 001 001100
0383 .0 001 001100
0384 .0 001 001100
0385 .0 001 001100
0386 .0 001 001100
0387 .0 001 001100
0388 .0 001 001100
0389 .0 001 001100
0390 .0 001 001100
0391 .0 001 001100
0392 .0 001 001100
0393 .0 001 001100
0394 .0 001 001100
0395 .0 001 001100
0396 .0 001 001100

RENDIX M2S, 28 AUGUST 1975
BACKGROUND LEVEL = 060
INTERVAL = 5
BAND = 5

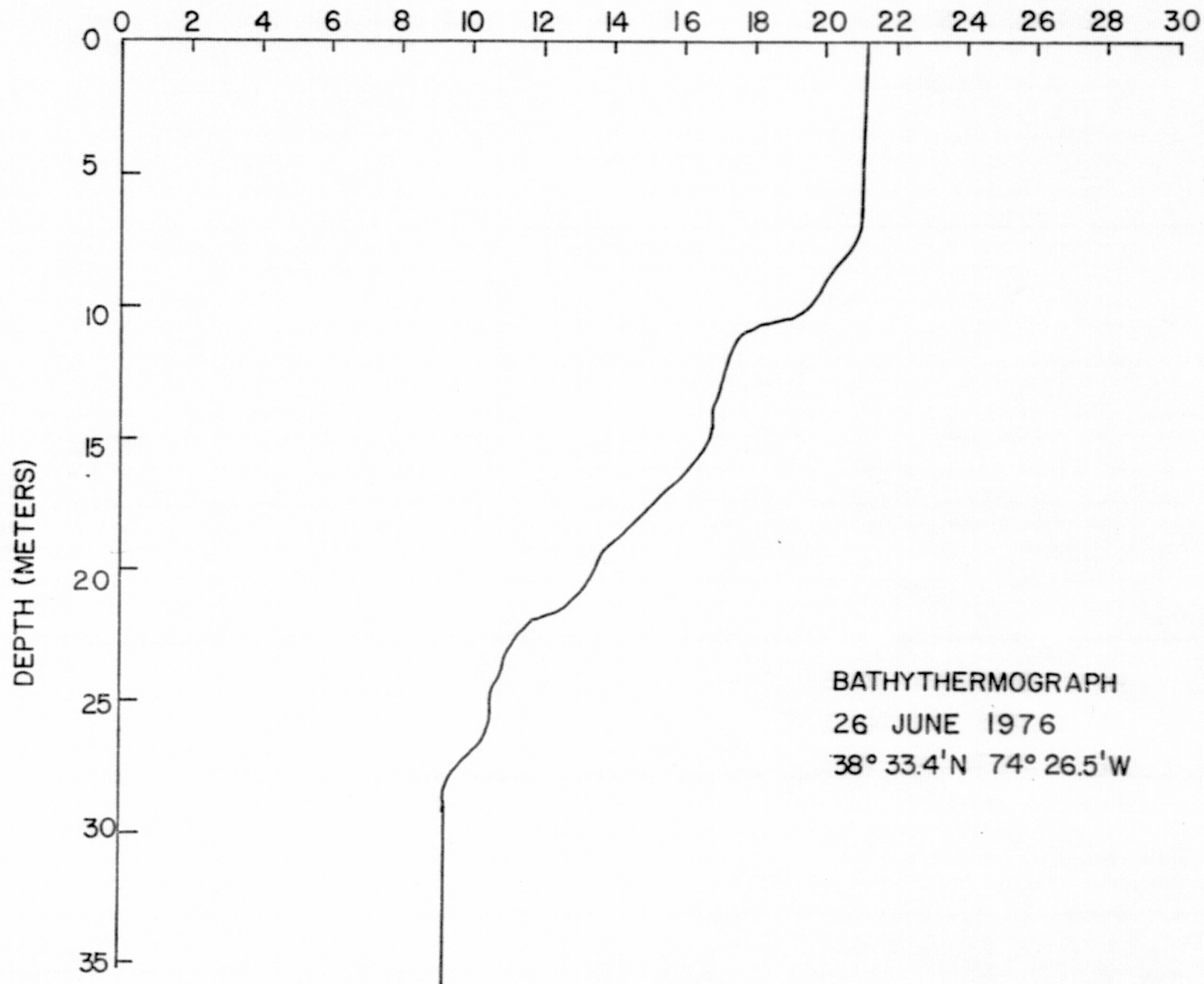
```
PIXEL # BEGIN = 0400
PIXEL # END   = 0519
```

[illegible]

OLDOUT FRAME 3

03 1 1. 0 .0 21. 1. . . . 319211.0.000.0.100. 0.0. 10. . . . 3
2 . 1 . . . 1.0. 0.5201.0.2.1. . . . 113. 0.0 . . . 0.1.0 . . . 1. . . . 0 60.
0 . . . 00. 00310100031.0.10001001 0 . . . 00.0.0100. 0 3
0 1 . . . 000.0.02150. . . . 036.020.20.0. 0.0 0 1010.210 0 . . . 1.1 . . . 0.
0.2 . . . 010 0 1100. . . . 001600010 21.0.1 0.00.0.0.1. . . 0 . . . 0.1 . . .
1 7841 0.0001. 22012.320011.0.1. . . . 0.0 . . . 0 . . .
0044333231. . . . 2210000221.01.000. . . . 101.0.00.1 . . . 0
0.00.105120. . . . 010.1.0010 0 122511.3.204100. . . 0.00. . . 0
1. . . 01100.10130. . . . 0 0.003283.0.01 1. . . . 22.0 00 . . . 0
0.210 . . . 02.2. . . . 01.0 0 030 05234.0 1 1. . . 0 1 . . . 10.
102.101010001000. . . . 02510.1220.451.0. . . . 001
0110.10210. . . . 2.0.0123.1.3223011102210 001.0 . . . 1.0
111. . . . 100 00.3100.1.10. 0.103.0.3502.074101102041. 0 0.0. . . 0
31.10. . . . 041723.2111200.0210000.12204.4310. . . 11042102. . . 0
110.11201331011233022.6101.11410103001.21.020.31.10. . . 1
114455730.02101010127692.24351012302001.01111001.10.10001.0 010. . . 10.1. . . 01.
06413214.0211.0.21043953263 0 112 0.0.0100. . . 0.0. . . 0 14
4 3.0.3401.111011011016200.01111.001011 0 1.1. . . 1 0 0.0 0 0 . . . 0
2020.113.01032201.11152.11121.1.0010.1.1. . . 1 1. . . 0000 10 20
1.11.00202000201202 011113.010100.0.1. . . 0.1.10.0 0 . . .
10 1.2.2020032201.2001020000001.10101101.001013. . . 121. . . 1
2.1.2.12250200.01.0.100000.1.2012111202.112.12.0.10. . . 0
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0102214012140401. . . . 000.0.0311341263360.130.0. . . 1 3330 . . . 0
0110.600014022011200.0011121423341462401. . . 1. . . 1.0. . . 0
02000.0.11311011020000000.355334443A021.111 1 . . . 0
000.11. . . 01.10201010031101.00022880224.200.00.0 0 . . . 0
0.1 2100.202.1.12010. . . 1306100212286022000101.0. . . 0
0200.05330121011.2. . . 01101012413210121221.01000 0.0 . . . 1.0. . . 0
1 2.0023220.01110 0. . . . 66321.1111101.011 . . . 0 . . . 0.2. . . 40. . . 0
0 1.52005536111. . . . 0001.10003321030110113221.101.1 . . . 1. . . 020. . . 421 . . . 0
202 84450000200.0 02036311140001567102.301. . . 300.0 . . . 11 0 0.000. . . 00
0. . . 1.01151227.11.101.1.020101002010. . . 122000.2.362 . . . 1 0 . . . 0
1.1. . . 1021693.130000 1111.11203.11210201.000 001100 000 . . . 0
0 11013.111112.000.0001021011021221232154.11. . . 0. . . 0 . . . 0
000 . . . 01 100.101101.0111.103023212322279BN31RWG510 1 2 . . . 0
0410. . . . 11100013012111222010232212.22155RJ9B00C950.1 01 . . . 0
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0.204120110.12021422311112111110000.11000 3. 1 1.10. . . 0 0 . . . 0
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1101533102.0041122313220131411143111301100 1.0 . . . 0. . . 11 . . . 0 0 0 1 . . .
23201202.2010.1122310223131111301. . . . 0144. . . 001. . . 0 . . . 2 2 1 0
01001315121 10124102352221116120100100114 . . . 0 . . . 0 . . . 0
102.1.2276.0.101244331454121120002300.001021.1. 0
101.121418411220116320112452100002.1.00012.3.0132. 0
111001.113220113212121141510.111.000.1 . . . 22120.1001 . . . 1.0 . . . 1.0
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110004122321144462023213. . . . 030100002.1. . . 0320.2. . . 0 . . . 0
101.12231032224254132301.01111001000 1311 0.130 . . . 0 . . . 0.10 0 . . . 012
301032231302332161300101020000100.1 1.311.0.000 0. 0 . . . 0
032503114441122335120011000.101.0.00.00.1 001 . . . 0 . . . 0 0 1 . . . 0.12 . . . 0 9
12332241322424253312201.0 101100011100.023031 . . . 2 . . . 1. . . 1.10 . . . 0.30 . . .
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7522361533323321221300.0 111000.10211101.1 . . . 0 0 . . . 0.0.1 01. . . 0
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2433233241312123120212420.202210.10101. 0 1.01 . . . 21 . . . 0
0332243230312331.2022134212020.10012.0 . . . 0.0. . . 2.0 . . . 0 . . . 0
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0343424134466412032042402.000202 0.1.1200 . . . 0.1.01. . . 0401. . . 0
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2331322211121353112322201.3111.2 000. 0 . . . 00.1 33 . . . 0001 03 . . .

TEMPERATURE (°C)



Date 6/26/76

STATION 0

Location: 38°33.4'N-74°26.5'W
(52195.8/70388.7)

Description: Baseline station
prior to dump

Time: 0653-0710
Sun Angle: $\theta = 13^\circ$
Wind Speed: 10 knots
Wind Direction: SW
Wave Height: 2'
Surface Temp.: 21.15°C
Weather: Partly cloudy

Hydrocast:

<u>Time</u>	<u>Depth</u> m	<u>pH</u>	<u>S</u> ‰	<u>Fe¹</u> mg/l	<u>Chla</u> µg/l	<u>Seston Weight (mg/l)</u>					
						<u>NASA</u> <u>Total</u>	<u>% vol</u>	<u>Delaware</u> <u>Total²</u>	<u>% vol²</u>	<u>Total³</u>	<u>% vol³</u>
0655	Surface	8.0						6.86	153.37	9.79	107.37
	.5	8.0						--	--	--	--
	2	8.0						--	--	--	--

Secchi Depth: 14.5 m

<u>Transmissometer Cast</u>	<u>Depth (M)</u>	<u>Transmissibility (%)</u>
	Surface	62
	2	74
	14.5	74
	16.5	74

BT Cast 0700 Surface Temp. 21.15°C

<u>CTD</u>	<u>Depth (M)</u>	<u>Cond.</u>	<u>Temp. °C</u>	<u>S(‰)</u>
	Surface	50.92	21.15	
	2	50.94	21.15	

Date 1/26/76

STATION 0-1

Location: 38°34.9'N-74°24.3'W
(52168.2/70383.2)

Description: Lightfield station in plume
200 yds. from beginning
Dump began at 0731

Time: 0820-0827
Sun Angle: $\theta = 29.4^\circ$
Wind Speed: 10-15 knots
Wind Direction: SW
Wave Height: 2'
Surface Temp.:
Weather: Partly cloudy

Secchi Depth: 2.25 cm

<u>Transmissometer:</u>	Depth (m)	Transmissibility (%)
	0	.6
	2	6
	4	7
	16	70

Submarine Photometer:

Depth	Red	Green	Blue	Clear
4 m Deck	3K	3K	3K	10K
Sea	.3	.3	.3	100
Albedo	.3	.3	.3	10

Spectroradiometer: 0812-0825

Date 6/26/76

Time: 0814-0822

In acid, partially cloudy.

VIS	$\frac{\text{mw}}{\text{cm}^2 - \mu - \text{ster}} \text{N}_w$	$\frac{\text{mw}}{\text{cm}^2 - \mu - \text{ster}} \text{N}_z$	$\frac{\text{mw}}{\text{cm}^2 - \mu - \text{ster}} \text{H}_o^*$	IR	$\frac{\text{mw}}{\text{cm}^2 - \mu - \text{ster}} \text{N}_w$	$\frac{\text{mw}}{\text{cm}^2 - \mu - \text{ster}} \text{N}_z$	$\frac{\text{mw}}{\text{cm}^2 - \mu - \text{ster}} \text{H}_o$
405	.275	6.54	9.95	712	.695	9.32	50.0
415	.285	7.19	12.45	737	.357	6.01	42.8
425	.473	7.84	14.7	762	.316	4.38	44.5
435	.608	7.84	17.0	787	.314	3.86	49.2
445	.630	8.50	20.2	812	.233	3.40	40.6
455	.780	8.50	23.6	837	.192	3.14	37.5
465	.898	9.15	27.5	862	.239	3.01	41.8
475	1.06	9.15	31.2	887	.180	2.61	40.8
485	1.13	9.80	33.4	912	.098	1.70	24.8
495	1.26	9.80	33.2	937	.052	.980	13.0
505	1.24	9.80	35.8	962	.049	.719	8.0
515	1.44	10.5	36.8	987	.088	1.05	23.0
525	1.68	10.6	38.9	1012	.069	1.37	33.1
535	1.93	10.3	39.4	1037	.104	1.37	32.4
545	2.00	9.35	38.9	1062	.104	1.31	29.8
555	2.31	8.50	38.6	1087	.056	1.11	22.5
565	2.35	8.04	40.0				
575	2.54	8.37	40.6				
585	2.48	8.37	40.9				
595	2.12	7.32	42.5				
605	1.94	7.25	44.8				
615	1.93	7.71	46.5				
625	1.73	7.78	46.8				
635	1.59	7.19	46.8				
645	1.39	6.41	45.3				
655	1.23	6.08	45.3				
665	1.18	6.41	47.4				
675	1.17	6.67	50.2				
685	.987	6.60	49.6				
695	.908	6.01	48.6				

*H_o is approximated from noisy data.

Date 6/26/76

STATION 1

Location: 38°35.1'N-74°24.0'W
(52164.9/70382.4)

Description: Helicopter passes 0831,
0836, 0840

Time: 0831-0844
Sun Angle: 0833/θ = 32°
Wind Speed: 10-15 knots
Wind Direction: SW
Wave Height: 2'
Surface Temp.: 21.4°C
Weather: Partly cloudy

Hydrocast:

Time	Depth m	pH	S ‰	Fe ¹ mg/l	Chl _a μg/l	Seston Weight (mg/l)					
						NASA Total	% vol	Delaware Total ²	% vol ²	Total ³	% vol ³
0833	Surface	7.95									
	.5	8.0						3.57	42.27	0.91	216.33
	2	7.9						1.24	74.55	2.37	38.86
								--	--	--	--

Secchi Depth: 14.5 m

Sun angle: 0833 = 32°

<u>Transmissometer:</u>	Depth (m)	% Transmissometer
	Surface	69
	2	68
	14	74
	16	74

<u>CTD</u>	Depth (m)	Cond.	Temp. (°C)	S(‰)
	Surface	51.1	21.76	
	2	51.1	21.76	

Radiometry: 0834-0845

Date 6/26/76

Time: 0834-0845

Sun partially obscured by clouds

VIS	mw/ cm ² -μ-ster N _w	mw/ cm ² -μ-ster N _z	mw/ cm ² -μ H _o *	IR	mw/ cm ² -μ-ster N _w	mw/ cm ² -μ-ster N _z	mw/ cm ² -μ H _o
405	.529	20.2	10.3	712	.480	25.1	45.3
415	.565	23.6	14.6	737	.392	20.9	44.3
425	.654	25.7	12.3	762	.376	20.7	42.8
435	.761	27.8	12.5	787	.454	20.8	42.0
445	.886	30.8	22.1	812	.343	17.5	40.8
455	.935	33.0	24.4	837	.327	15.4	40.3
465	1.08	36.3	25.0	862	.327	16.2	41.8
475	1.16	37.2	26.0	887	.317	15.8	38.3
485	1.13	36.5	27.7	912	.173	10.4	21.8
495	1.01	35.3	28.2	937	.098	5.9	9.3
505	.944	35.7	30.1	962	.098	4.5	13.3
515	.938	35.4	32.6	987	.154	9.0	25.8
525	.964	35.8	33.8	1012	.193	10.9	27.8
535	.944	34.1	35.0	1037	.203	11.2	30.3
545	.771	29.6	36.6	1062	.190	10.1	32.6
555	.752	29.9	38.1	1087	.137	7.9	--
565	.788	31.4	38.4				
575	.725	29.9	38.9				
585	.631	28.1	39.5				
595	.614	28.5	40.4				
605	.699	31.0	41.4				
615	.634	31.4	42.3				
625	.634	29.4	43.8				
635	.595	27.7	45.0				
645	.510	27.3	46.5				
655	.536	26.4	48.0				
665	.618	36.2	48.9				
675	.569	27.7	49.5				
685	.510	27.0	48.5				
695	.542	25.6	44.8				

*H_o is approximated from noisy data.

Date 6/26/76

STATION 2

Location: 38°34.9'N-74°24.1'W
(52168.2/70383.7)

Description: Helicopter pass 0850

Time: 0850-0906
Sun Angle: --
Wind Speed: 10-15 knots
Wind Direction: SW
Wave Height: 2'
Surface Temp.: 21.3°C
Weather: Overcast

Hydrocast:

Time	Depth m	pH	S ‰	Fe ¹ mg/l	Chl α μ g/l	Seston Weight (mg/l)		Delaware		Total ³	
						NASA Total	% vol	Total ²	% vol ²	Total ³	% vol ³
?	Surface	7.95						4.34	60.64	4.18	62.95
	.5	7.95						4.49	49.41	2.71	82.03
	2	7.95						5.90	45.01	4.91	54.11

Secchi Depth: 2 m

<u>Transmissometer:</u>	Depth (m)	% Transmissibility
	Surface	2.5
	2	8
	4	8

<u>CTD</u>	Depth (m)	Cond.	Temp. (°C)	S‰
	Surface	50.02	21.8	
	2	50.02	21.8	

Radiometry: 0848-0906

Date 6/26/76

Time: 0848-0855

--heavily overcast; moving in and out
of concentrated plume

VIS	mw/ cm ² -μ-ster N _w	mw/ cm ² -μ-ster N _Z	mw/ cm ² -μ H _⊙	IR	mw/ cm ² -μ-ster N _w	mw/ cm ² -μ-ster N _Z	mw/ cm ² -μ H _⊙
405	.444	14.8		712	.755	17.7	
415	.611	17.3		737	.575	15.4	
425	.640	18.7		762	.529	14.7	
435	.699	19.7		787	.516	15.0	
445	.902	22.5		812	.415	12.1	
455	.997	24.8		837	.373	14.6	
465	1.08	25.8		862	.399	15.0	
475	1.07	26.0		887	.343	11.2	
485	1.23	26.3		912	.245	7.7	
495	1.17	25.8		937	.203	4.1	
505	1.29	25.7		962	.176	3.4	
515	1.40	25.1		987	.209	6.7	
525	1.61	25.2		1012	.222	8.3	
535	1.66	24.5		1037	.209	8.2	
545	1.77	23.0		1062	.219	7.7	
555	2.07	22.5		1087	.124	6.4	
565	2.31	21.9					
575	2.43	21.5					
585	2.19	21.2					
595	2.08	21.1					
605	1.89	21.5					
615	1.94	21.9					
625	1.70	21.3					
635	1.48	20.6					
645	1.38	19.2					
655	1.32	18.8					
665	1.27	19.2					
675	1.12	19.9					
685	1.06	19.8					
695	.925	19.1					

Date 6/26/76

STATION 3

Location: 38°35'N-74°23.5'W
(52163.0/70385.8)

Description:

Time: 0906-0910
Sun Angle: --
Wind Speed: 10-15 knots
Wind Direction: SW
Wave Height: 2'
Surface Temp.: 21.3°C
Weather: Overcast

Hydrocast:

Time	Depth m	pH	S ‰	Fe ¹ mg/l	Chl _a µg/l	Seston Weight (mg/l)		Delaware		Total ³	
						NASA Total	% vol	Total ²	% vol ²	Total ³	% vol ³
0906	Surface	7.8						4.14	31.60	5.46	23.93
	.5	7.8						?	?	?	?
	2	8.0						2.25	35.75	3.81	21.12

Secchi Depth: 3.5 m

Transmissometer:	Depth (m)	% Transmissibility
	Surface	22
	2	21
	3.5	40
	5.5	5

CTD	Depth (m)	Cond.	Temp. (°C)	S‰
	Surface	50.73	21.66	
	2	50.69	21.66	

Date 6/26/76

Time: 0858-0906

--Ship underway - moving in and out of acid

--Some bow spray

VIS	mw/ cm ² -μ-ster N _w	mw/ cm ² -μ-ster N _z	mw/ cm ² -μ H _⊙	IR	mw/ cm ² -μ-ster N _w	mw/ cm ² -μ-ster N _z	mw/ cm ² -μ H _⊙
405	.640	16.7		712	1.052	21.2	
415	.758	19.3		737	.833	18.4	
425	.843	21.5		762	.739	17.5	
435	.977	22.2		787	.771	18.0	
445	1.121	24.7		812	.608	14.6	
455	1.297	28.1		837	.572	16.6	
465	1.44	29.3		862	.618	13.9	
475	1.40	29.0		887	.549	13.2	
485	1.61	29.8		912	.395	8.9	
495	1.66	29.9		937	.176	4.7	
505	1.76	30.0		962	.167	4.6	
515	1.82	28.6		987	.359	7.8	
525	2.09	28.0		1012	.464	9.7	
535	2.10	28.3		1037	.422	9.7	
545	2.01	28.7		1062	.441	9.2	
555	2.07	25.8		1087	.294	7.2	
565	2.04	24.7					
575	2.09	25.1					
585	1.91	25.1					
595	1.70	24.1					
605	1.63	24.6					
615	1.78	25.4					
625	1.63	24.9					
635	1.74	23.7					
645	1.53	22.9					
655	1.35	22.2					
665	1.30	22.1					
675	1.25	22.7					
685	1.67	22.8					
695	1.01	22.2					

Date 6/26/76

STATION 4

Location: 38°34.7'N-74°23'W
(52161.6/70387.4)

Description: Helicopter pass - 0913

Time: 0911-0920
Sun Angle:
Wind Speed: 10-15 knots
Wind Direction: SW
Wave Height: 2' - white caps
Surface Temp.: 21.4°C
Weather: Overcast

Hydrocast:

Time	Depth m	pH	S ‰	Fe ¹ mg/l	Chlα μg/l	Seston Weight (mg/l)		Delaware		Total ³	
						NASA Total	% vol	Total ²	% vol ²	Total ³	% vol ³
0917	Surface	7.95						3.52	54.03	2.82	67.29
	.5	8.0						1.84	64.77	2.99	51.43
	2	7.8						1.85	23.16	2.46	17.46

Secchi Depth: 3.5 m

<u>Transmissometer:</u>	Depth (m)	% Transmissibility
	Surface	13
	2	15
	3.5	17
	5.5	18

<u>CTD:</u>	Depth (m)	Cond.	Temp. (°C)	S(‰)
	Surface	50.96	21.87	
	2	50.92	21.87	

Date 6/26/76

Time: 0911-0917

In acid
Overcast

VIS	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}}$ $\frac{\text{N}}{\text{W}}$	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}}$ $\frac{\text{N}}{\text{Z}}$	$\frac{\text{mw}}{\text{cm}^2-\mu}$ $\frac{\text{H}}{\text{O}}$	IR	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}}$ $\frac{\text{N}}{\text{W}}$	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}}$ $\frac{\text{N}}{\text{Z}}$	$\frac{\text{mw}}{\text{cm}^2-\mu}$ $\frac{\text{H}}{\text{O}}$
405	.59	15.6		712	.797	19.3	
415	.67	18.2		737	.709	16.2	
425	.60	19.4		762	.693	15.6	
435	.81	20.7		787	.703	16.0	
445	1.08	23.5		812	.395	13.4	
455	1.20	25.8		837	.379	11.8	
465	1.24	27.2		862	.422	12.2	
475	1.31	27.4		887	.343	12.1	
485	1.36	27.4		912	.242	8.3	
495	1.41	26.9		937	.127	4.5	
505	1.61	26.9		962	.104	3.3	
515	1.62	26.4		987	.232	6.7	
525	1.68	26.1		1012	.265	8.3	
535	1.84	25.4		1037	.248	8.3	
545	1.95	24.3		1062	.274	7.9	
555	2.05	23.5		1087	.154	6.6	
565	2.03	22.8					
575	2.11	22.3					
585	1.97	22.1					
595	1.85	21.9					
605	1.59	22.1					
615	1.54	22.7					
625	1.44	22.3					
635	1.31	21.4					
645	1.17	20.0					
655	1.08	19.4					
665	1.06	19.9					
675	1.05	20.7					
685	.91	20.2					
695	.79	19.4					

Date 6/26/76

STATION 3A

Location: 38°35.3'N-74°22.9'W
(52156.3/70383.6)

Description: Light field station in plume

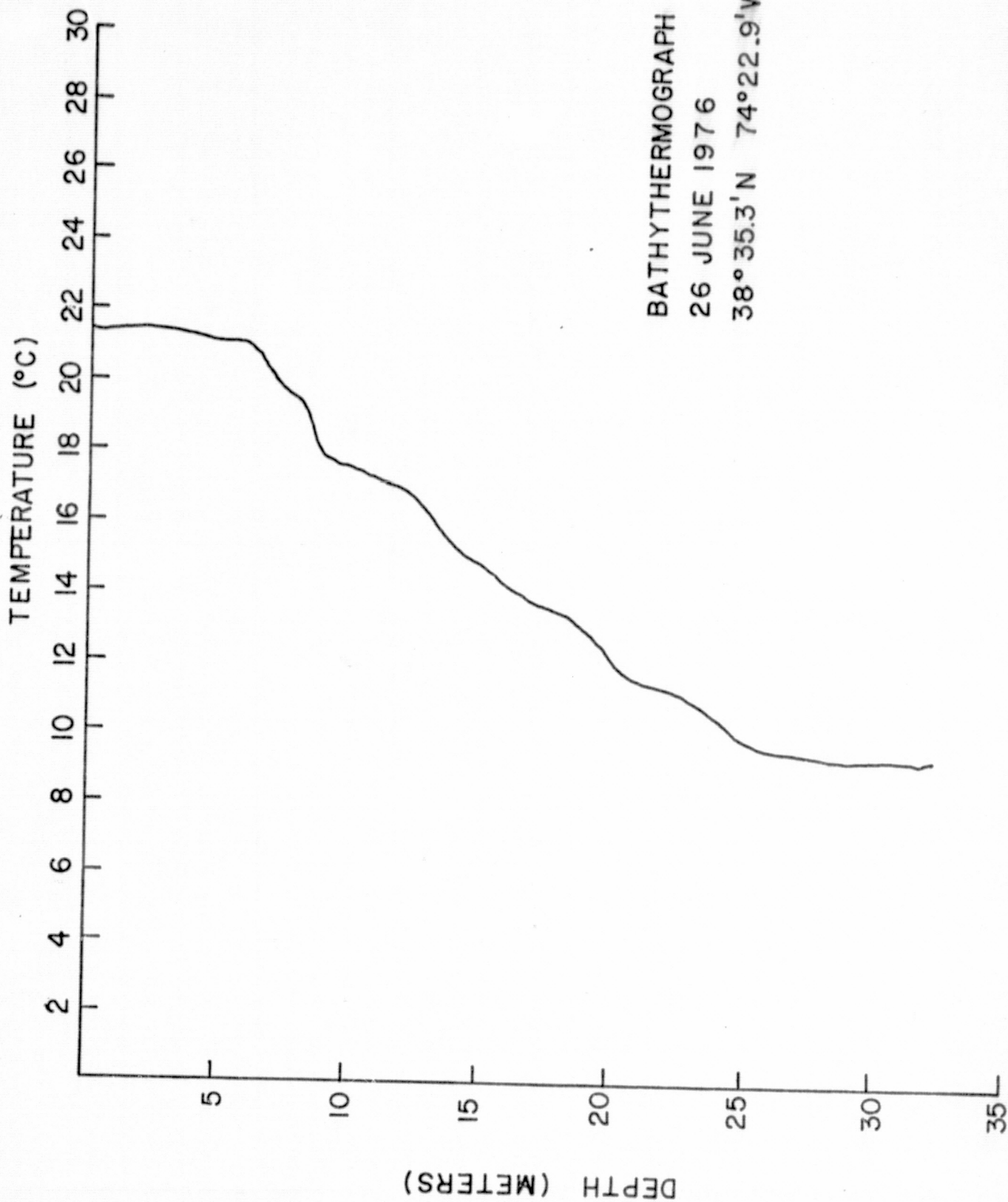
Time: 1033-1055
Sun Angle:
Wind Speed: 10-15 knots
Wind Direction: SW
Wave Height: 2'
Surface Temp.: 21.35°
Weather: Partly sunny

Secchi Depth: 3.5 m

<u>Transmissometer:</u>	Depth (m)	% Trans.	Depth (m)	% Trans.
	Surface	27.1	10	73.2
	2	27.1	11	78.4
	4	20.9	12	80.5
	5	19.9	14	80.5
	6	12.5	15	79.4
	7	10.5	16	79.4
	8	62.7	17	79.4
	9	50.2		

Submarine Photometer

<u>Depth</u>	Red	Green	Blue	Clear
Surf. deck	3K	3K	3K	10K
sea	3K	3L	3K	10K
albedo	100	100	30	300
2 deck	3K	3K	3K	10K
sea	3K	3K	1K	3K
albedo	10	30	3	100
3.5 deck	3K	3K	3K	10K
sea	3K	3K	1K	3K
albedo	10	30	3	100
5.5 deck	3K	3K	3K	10K
sea	300	1K	100	1K
albedo	10	30	.3	100



BATHYTHERMOGRAPH
26 JUNE 1976
38°35.3'N 74°22.9'W

Date 6/26/76

Time: 1033-1042

In fairly high concentration of acid
Totally overcast

VIS	$\frac{\text{mw/}}{\text{cm}^2-\mu\text{-ster}} \text{N}_w$	$\frac{\text{mw/}}{\text{cm}^2-\mu\text{-ster}} \text{N}_z$	$\frac{\text{mw/}}{\text{cm}^2-\mu} \text{H}_\odot$	IR	$\frac{\text{mw/}}{\text{cm}^2-\mu\text{-ster}} \text{N}_w$	$\frac{\text{mw/}}{\text{cm}^2-\mu\text{-ster}} \text{N}_z$	$\frac{\text{mw/}}{\text{cm}^2-\mu} \text{H}_\odot$
405	.66	19.1		712	.833	22.0	
415	.75	22.7		737	.716	19.3	
425	.82	24.8		762	.601	15.6	
435	.97	25.6		787	.605	18.4	
445	1.11	28.7		812	.549	15.1	
455	1.27	31.0		837	.477	13.8	
465	1.32	32.7		862	.471	14.3	
475	1.39	34.2		887	.444	13.5	
485	1.49	34.2		912	.376	10.2	
495	1.56	32.3		937	.219	5.0	
505	1.63	32.2		962	.134	4.0	
515	1.67	31.6		987	.225	8.0	
525	1.79	32.0		1012	.281	9.7	
535	1.95	31.4		1037	.307	9.6	
545	2.02	28.1		1062	.301	8.8	
555	2.10	28.0		1087	.232	6.8	
565	2.12	27.6					
575	2.08	26.6					
585	1.91	26.0					
595	1.71	26.1					
605	1.56	27.0					
615	1.43	27.0					
625	1.27	26.0					
635	1.18	25.7					
645	1.10	24.1					
655	1.02	22.6					
665	.99	23.1					
675	1.00	24.4					
685	95	24.4					
695	.85	22.8					

Date 6/26/76

STATION 5

Location: 38°33.5'N-74°22.4'W
(52169/70396)

Description: Helicopter pass - 1603

Time: 1559-1609
Sun Angle: $\theta = 52^{\circ}$
Wind Speed: Light
Wind Direction: Variable
Wave Height: 1'
Surface Temp.: 21.8°C
Weather: Hazy but sunny

Hydrocast:

<u>Time</u>	<u>Depth</u> m	<u>pH</u>	<u>S</u> ‰	<u>Fe</u> ¹ mg/l	<u>Chl</u> _a µg/l	<u>Seston Weight</u> (mg/l)		<u>Delaware</u>		<u>Total</u> ³	
						<u>NASA</u> Total	<u>% vol</u>	<u>Total</u> ²	<u>% vol</u> ²	<u>Total</u> ³	<u>% vol</u> ³
1603	Surface	7.9						5.81	53.01	5.83	52.83
	.5	7.95						4.88	52.54	5.96	52.98
	2	7.95						2.77	61.23	4.30	39.39

Secchi Depth: 5.0m/3.5m

<u>Transmissometer:</u>	<u>Depth (m)</u>	<u>% Transmissibility</u>
	Surface	25.0
	2	25.5
	5	16.0
	7	62.0

<u>CTD</u>	<u>Depth (m)</u>	<u>Cond.</u>	<u>Temp. (°C)</u>	<u>σ (‰)</u>
	Surface	52.1	23.19	
	2	51.5	22.62	

¹Iron in suspended solids

²Average salt correction

³Individual salt correction

Date 6/26/76

Time: 1559-1610

In acid - fairly concentrated
Partially cloudy

VIS	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}} \text{N}_w$	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}} \text{N}_z$	$\frac{\text{mw}}{\text{cm}^2-\mu \text{H}_o}$	IR	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}} \text{N}_w$	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}} \text{N}_z$	$\frac{\text{mw}}{\text{cm}^2-\mu \text{H}_o}$
405	.56	12.7	33.0	712	.157	8.3	93.8
415	.61	16.0	41.3	737	.144	7.4	81.0
425	.67	16.6	47.0	762	.111	6.6	76.3
435	.77	15.9	51.8	787	.111	6.5	78.9
445	.92	17.2	61.6	812	.105	5.3	72.3
455	1.12	19.7	70.4	837	.085	4.6	63.6
465	1.16	20.8	73.6	862	.078	4.6	65.2
475	1.24	20.5	78.9	887	.072	4.2	64.5
485	1.34	17.9	84.2	912	.065	2.9	44.3
495	1.37	16.5	84.9	937	.078	1.6	33.8
505	1.55	18.8	88.2	962	.026	1.4	20.6
515	1.66	19.6	88.4	987	.052	2.2	42.0
525	1.80	16.0	90.4	1012	.046	2.2	49.6
535	1.97	13.5	92.0	1037	.046	2.2	48.7
545	1.98	13.7	88.9	1062	.039	2.3	45.0
555	1.97	14.5	87.9	1087	.033	1.8	37.6
565	1.92	13.8	88.2				
575	1.70	11.3	87.6				
585	1.48	10.5	88.2				
595	.99	11.5	88.3				
605	.81	12.7	91.8				
615	.75	12.1	95.6				
625	.56	10.4	94.4				
635	.50	9.9	88.7				
645	.44	9.8	85.4				
655	.39	9.8	84.8				
665	.37	9.8	88.0				
675	.35	9.4	89.4				
685	.34	9.0	90.6				
695	.30	9.1	91.2				

Date 6/26/76

STATION 6

Location: 38°33.5'N-74°21.2'W
(52170.9/70398.8)

Description: Helicopter pass - 1618

Time: 1617-1627
Sun Angle:
Wind Speed: Calm
Wind Direction:
Wave Height: 1'
Surface Temp.: 22.2°C
Weather: Hazy & sunny

Hydrocast:

Time	Depth m	pH	S ‰	Fe ¹ mg/l	Chl α μ g/l	Seston Weight (mg/l)					
						NASA Total	% vol	Delaware Total ²	% vol ²	Total ³	% vol ³
1617	Surface	7.9									
	.5	7.5						5.84	33.03	5.69	33.90
	2	7.95						0.60	213.11	--	--

Secchi Depth: 7 m

<u>Transmissometer:</u>	Depth (m)	% Transmissibility
	Surface	30.5
	2	32.0
	7	62.0
	9	63.0

<u>CTD</u>	Depth (m)	Cond.	Temp. (°C)	S‰
	Surface	52.2	23.17	
	2	51.49	22.37	

Date 6/26/76

Time: 1617-1626

Overcast (some patches of blue)

VIS	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}} \frac{N_w}{N_z}$	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}} \frac{N_z}{H_o}$	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}} \frac{H_o}{H_o}$	IR	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}} \frac{N_w}{N_z}$	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}} \frac{N_z}{H_o}$	$\frac{\text{mw}}{\text{cm}^2-\mu\text{-ster}} \frac{H_o}{H_o}$
405	.69	18.3		712	.89	25.9	
415	.74	22.2		737	.86	22.1	
425	.78	23.9		762	.82	19.2	
435	.91	24.4		787	.80	20.3	
445	1.22	27.7		812	.72	18.5	
455	1.21	31.2		837	.55	16.0	
465	1.31	32.9		862	.50	16.8	
475	1.34	32.6		887	.46	15.9	
485	1.42	32.5		912	.38	11.5	
495	1.56	32.5		937	.22	7.3	
505	1.46	32.1		962	.19	6.6	
515	1.45	31.5		987	.30	10.2	
525	1.55	31.9		1012	.34	11.3	
535	1.59	30.8		1037	.34	11.3	
545	1.48	29.0		1062	.31	10.9	
555	1.42	28.6		1087	.21	9.1	
565	1.49	28.0					
575	1.33	27.5					
585	1.38	27.4					
595	1.16	27.1					
605	1.21	27.5					
615	1.06	28.3					
625	1.10	28.1					
635	1.05	26.2					
645	.91	24.7					
655	.87	24.6					
665	.89	25.4					
675	.91	25.4					
685	.93	25.2					
695	.83	25.4					

Date 6/26/76

STATION 7

Location: 38°33.2'N-74°21.9'W
(52169.8/70399.0)

Description: Light field station

Time: 1630-1650
Sun Angle:
Wind Speed: Calm
Wind Direction:
Wave Height: 1'
Surface Temp.: 21.9°C
Weather: Overcast

<u>Transmissometer:</u>	Depth (m)	% Transmissibility
	Surface	35.0
	2	37.5
	4	44.5
	6	62.0
	8	62.0
	9	62.0
	11	62.0

Submarine Photometer:

Depth (m)	Red	Green	Blue	Clear	
Surface					
deck	1K	1K	1K	3K	
sea	1K	1K	1K	3K	
albedo	10	30	10	100	
2					
deck	1K	1K	1K	3K	
sea	300	300	300	1K	
albedo	3	10	10	30	
9.5					
deck	1K	1K	1K	3K	
sea	100	100-300	100	300	
albedo	0.3	1	0.3	3	
11.5					
deck	1K/1K	1K/1K	1K/3K	3K/10K	overcast,
sea	100/300	300/1K	100/300	300/1K	sun
albedo	.3/.3	1/3	.3/.3	3/3	

Secchi Depth: 9.5m/6m

Date 6/26/76

STATION 8

Location: 38°33.9'N-74°25'W
(3H5-3079.0/3H4-3417.8)

Description: Light field station

Time: 1733-1750
Sun Angle: 37°
Wind Speed: Calm
Wind Direction:
Wave Height: 1'
Surface Temp.: 21.95°C
Weather: Sunny

<u>Transmissometer</u>	Depth (m)	% Trans.	Depth (m)	% Trans.
	Surface	64.5		
	1	64.5	10	60.0
	2	65.0	11	60.0
	3	64.0	12	61.0
	4	63.5	13	66.5
	5	62.0	14	69.0
	6	62.5	15	70.5
	7	61.0	16	72.0
	8	60.5	17	72.0
	9	60.0	18	72.0

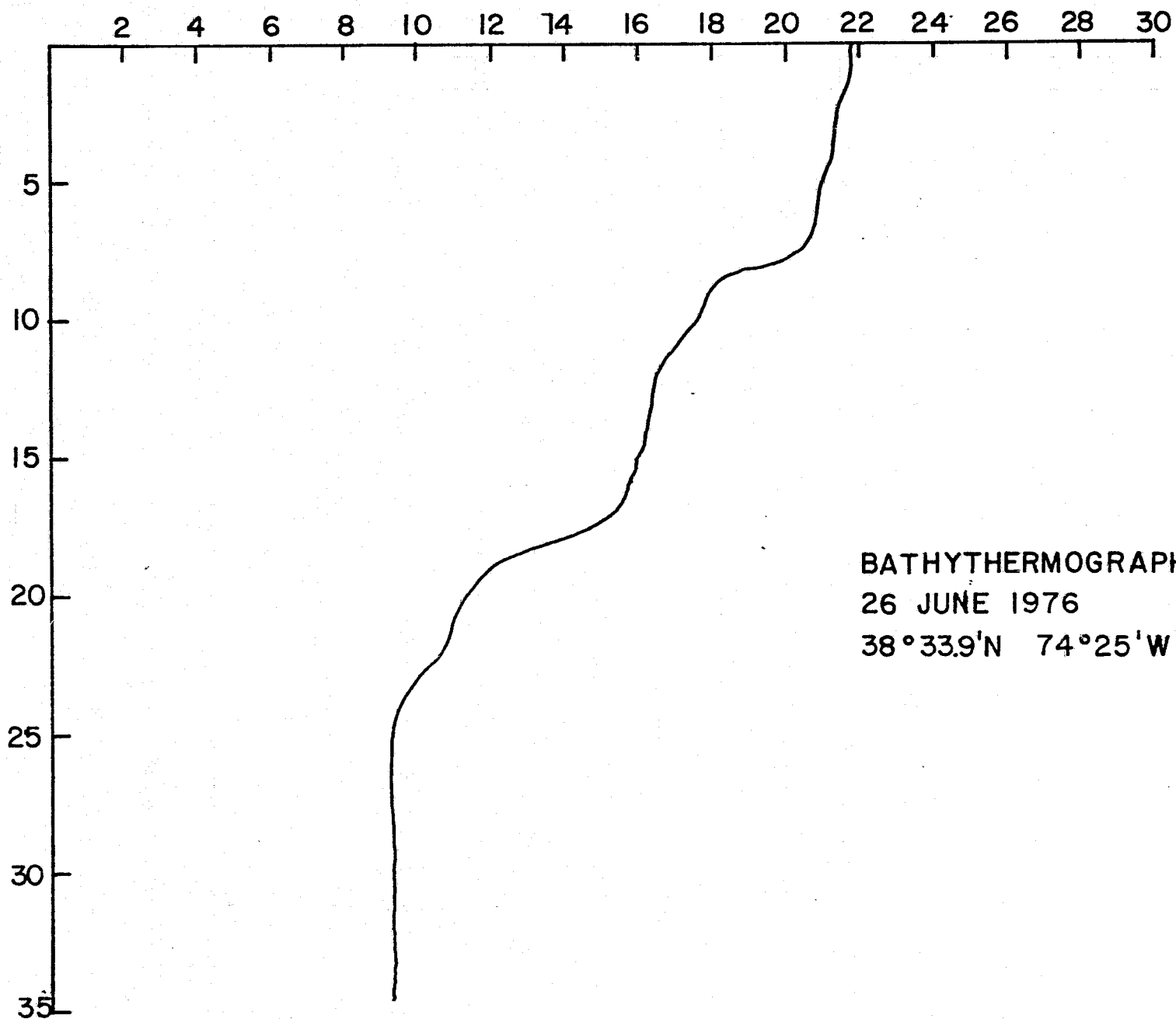
Secchi Depth: 14.5m/9.5m

Submarine Photometer:

<u>Depth (m)</u>	Red	Green	Blue	Clear
Surf. deck	1K	1K	1K	10K
sea	1K	1K	1K	3K
albedo	1	100	10	100
2 deck	1K	1K	1K	10K
sea	1K	1K	1K	3K
albedo	0.3	30	10	30
14.5 deck	1K	1K	1K	10K
sea	300	300	300	1K
albedo	3	3	1	3
16.5 deck	1K	1K	1K	10K
sea	300	300	300	1K
albedo	.3	3	1	3

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DEPTH (METERS)



BATHYTHERMOGRAPH
26 JUNE 1976
38°33.9'N 74°25'W

Date 6/26/76

Time: 1734-1747

--Partially cloudy -- no clouds in the vicinity of the sun or directly overhead.

VIS	mw/ cm ² -μ-ster N _w	mw/ cm ² -μ-ster N _z	mw/ cm ² -μ H _o	IR	mw/ cm ² -μ-ster N _w	mw/ cm ² -μ-ster N _z	mw/ cm ² -μ H _o
405	.32	5.69	3.74	712	.15	2.21	9.90
415	.38	6.34	4.56	737	.12	1.59	8.82
425	.43	6.61	5.14	762	.11	1.33	7.84
435	.44	6.61	5.74	787	.11	1.27	8.52
445	.53	6.85	7.00	812	.09	1.03	7.34
455	.59	7.08	7.99	837	.08	.90	6.70
465	.64	7.17	8.74	862	.07	.81	6.88
475	.60	7.08	9.16	887	.07	.71	6.54
485	.61	6.71	9.61	912	.06	.56	4.69
495	.63	6.19	9.66	937	.06	.29	2.24
505	.59	5.91	10.30	962	.05	.21	2.64
515	.58	5.67	10.09	987	--	.36	4.69
525	.52	5.23	10.34	1012	--	.39	5.13
535	.51	4.96	10.09	1037	--	.37	4.94
545	.44	4.54	9.84	1062	--	.32	4.58
555	.42	4.15	9.74	1087	--	.25	3.62
565	.38	3.76	9.74				
575	.33	3.53	9.58				
585	.29	3.46	9.68				
595	.26	3.43	9.82				
605	.25	3.25	10.22				
615	.23	3.14	10.44	z 37°			
625	.20	3.07	10.34				
635	.19	2.90	9.78				
645	.19	2.63	9.52				
655	.18	2.52	9.34				
665	.19	2.46	9.62				
675	.18	2.51	9.90				
685	.18	2.53	9.80				
695	.16	2.43	9.74				